

Robert Prior

Word Puzzles

from *Nelson Physics 12*

Crossword and word search puzzles for every chapter and unit, with solutions,



Image © Wikimedia Commons. Used under Creative Commons license.

Chapter 1

Kinematics

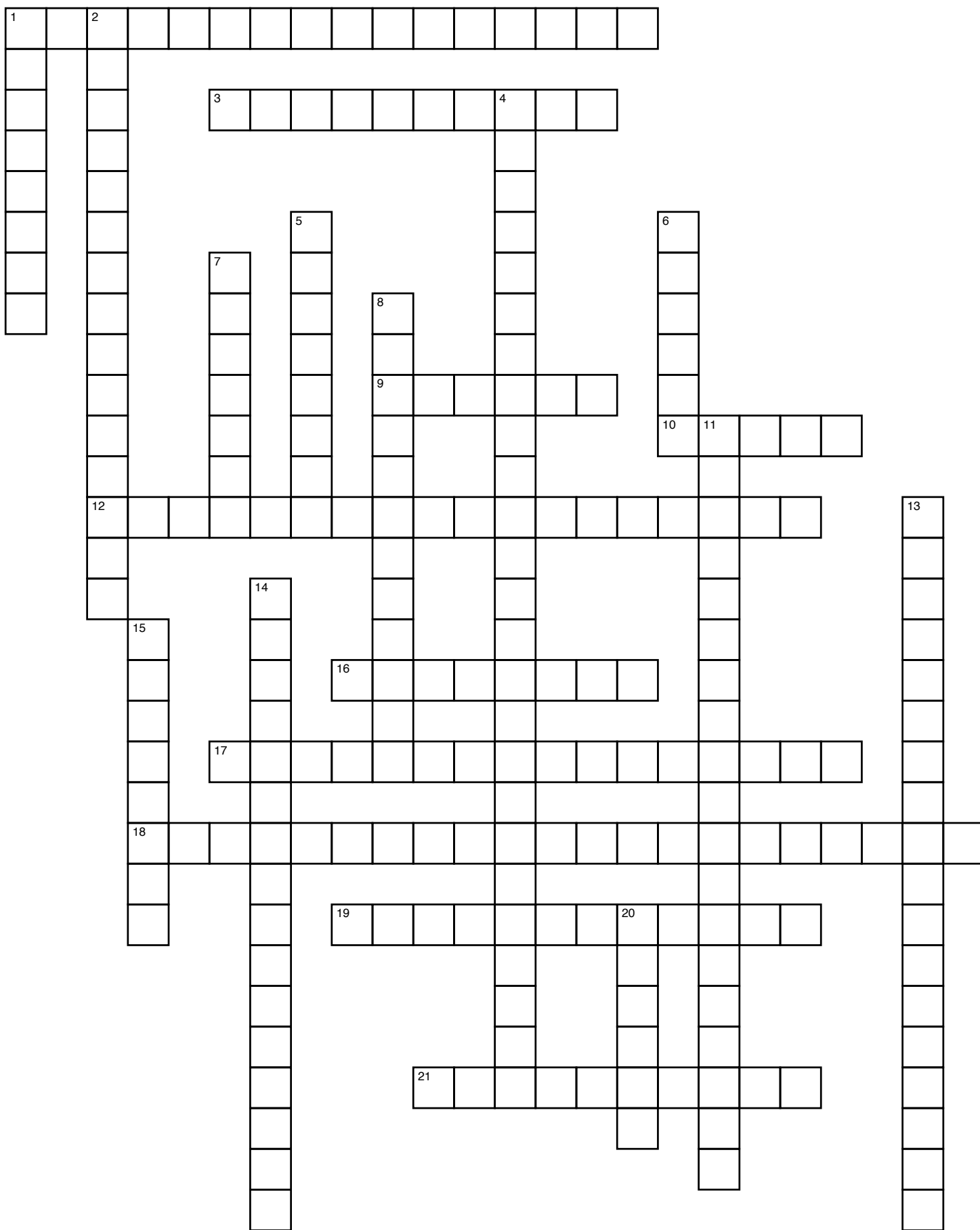
Across

1. a coordinate system relative to which motion is described or observed (three words)
3. an object that is launched through the air along a parabolic trajectory and accelerates due to gravity
9. a straight line connecting two separate points on a curve
10. the horizontal displacement of a projectile
12. the speed of an object at a particular instant; the magnitude of the slope of the tangent to a position-time graph (two words)
16. the change in position divided by the time interval
17. the velocity of an object relative to a specific frame of reference (two words)
18. the velocity of an object at a particular instant; the slope of the tangent to a position-time graph (two words)
19. the total distance travelled divided by the total time to travel that distance (two words)

21. the study of motion without considering the forces that produce the motion

Down

1. the motion of a falling object where the only force acting on the object is gravity (two words)
2. the displacement divided by the time interval for that change; the slope of a secant on a position-time graph (two words)
4. the acceleration at a particular instant in time (two words)
5. the straight-line distance and direction of an object from a reference point
6. a quantity that has both magnitude (size) and direction
7. a straight line that intersects a curve at a point and has the same slope as the curve at the point of intersection
8. the change in position of an object
11. the change in velocity divided by the time interval for that change (two words)
13. in two dimensions, either of the x-vector and y-vector that are combined into an overall vector (four words)
14. the motion of a projectile such that the horizontal component of the velocity is constant, and the vertical motion has a constant acceleration due to gravity (two words)
15. the study of the causes of motion
20. a quantity that has magnitude (size) but no direction





Chapter 2

Dynamics

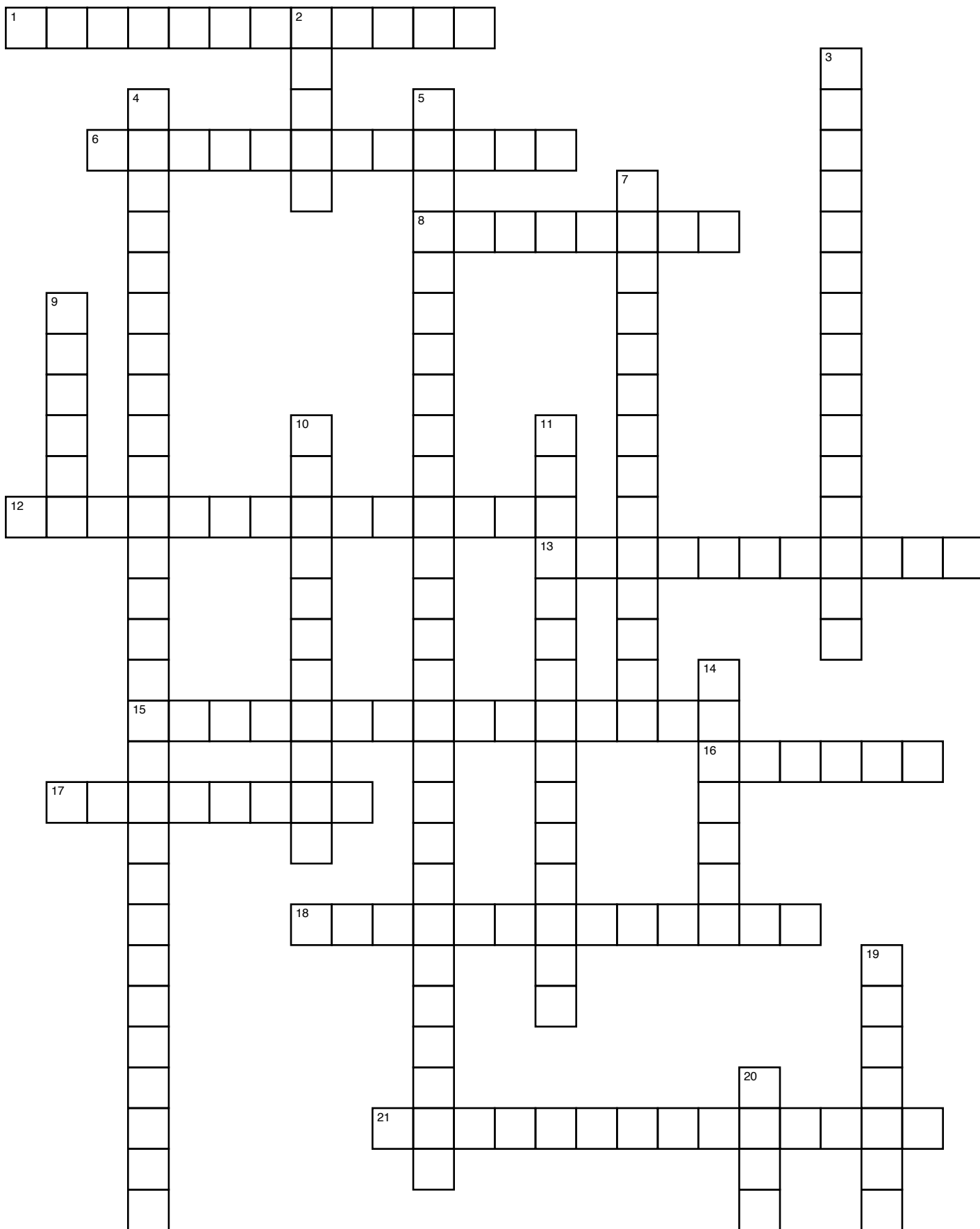
Across

1. a force due to one object pushing or pulling on another (two words)
6. a force that acts between two objects when they touch each other (two words)
8. a force that opposes the sliding of two surfaces across one another; acts opposite to motion or attempted motion
12. a force that resists attempted motion between two surfaces in contact (two words)
13. a state in which an object has no net force acting on it
15. a force that acts between two objects without the objects touching; also called action-at-a-distance force (two words)
16. the SI unit of force
17. the sum of all the forces acting on an object (two words)
18. the friction between objects and the air around them (two words)
21. the force of attraction between all objects due to mass (three words)

Down

2. a push or a pull
3. a simple line drawing that shows all the forces acting on an object (two words)
4. the ratio of kinetic friction to the normal force (four words)
5. the ratio of the maximum force of static friction to the normal force (four words)
7. a device that converts energy into linear motion (two words)
9. the gravitational force exerted by Earth on an object
10. a force perpendicular to the surface between objects in contacts (two words)
11. a force exerted on a moving object by a surface in the direction of motion opposite to the motion of the object (two words)
14. a force exerted by objects that can be stretched
19. a measure of an object's resistance to change in velocity

20. a measure of the amount of matter in an object





Chapter 3

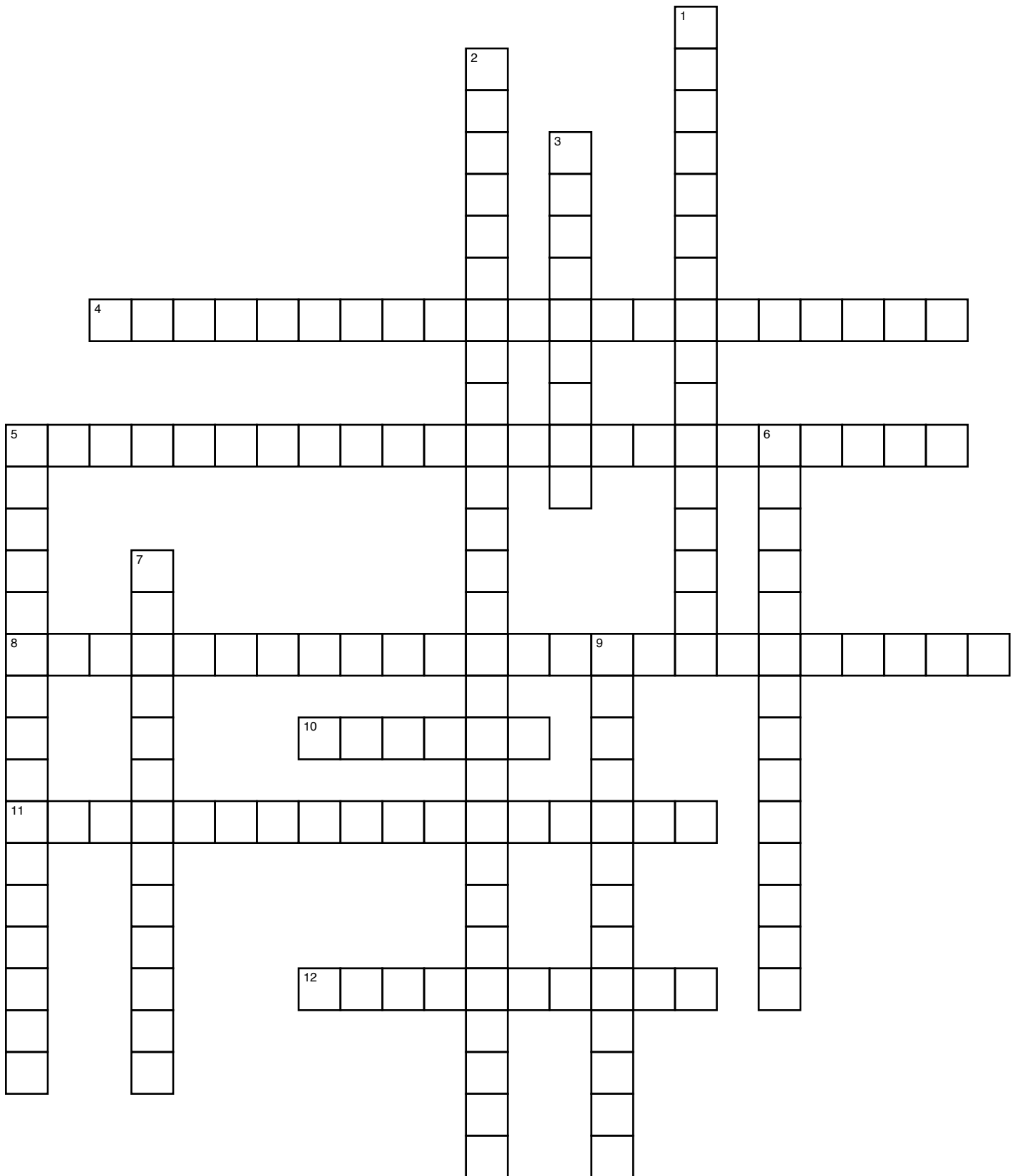
Uniform Circular Motion

Across

4. the motion of an object with a constant speed along a circular path of constant radius (three words)
5. the instantaneous acceleration that is directed toward the centre of a circular path (two words)
8. a frame of reference that moves at a zero or constant velocity; the law of inertia holds (four words)
10. the time required for a rotating, revolving, or vibrating object to complete one cycle
11. a situation in which the value of gravity has been changed artificially to more closely match Earth's gravity (two words)
12. a rapidly rotating device used to separate substances and simulate the effects of gravity
13. the net force that causes centripetal acceleration (two words)

Down

1. a coordinate system relative to which motion is described or observed (three words)
2. a frame of reference that accelerates with respect to an inertial frame; the law of inertia does not hold (four words)
3. the number of rotations, revolutions, or vibrations of an object per unit of time; the inverse of period
5. the fictitious force in a rotating (accelerating or non-inertial) frame of reference (two words)
6. the magnitude of the normal force acting on an object in an accelerated (non-inertial) frame of reference (two words)
7. a fictitious force that acts perpendicular to the velocity of an object in a rotating frame of reference (two words)
9. an apparent but non-existent force invented to explain the motion of objects within an accelerating (non-inertial) frame of reference (two words)





Unit 1

Dynamics

Across

1. a frame of reference that moves at a zero or constant velocity; the law of inertia holds (four words)
4. a situation in which the value of gravity has been changed artificially to more closely match Earth's gravity (two words)
7. the gravitational force exerted by Earth on an object
9. the force of attraction between all objects due to mass (three words)
12. a measure of an object's resistance to change in velocity
13. the motion of a falling object where the only force acting on the object is gravity (two words)
14. a straight line connecting two separate points on a curve
15. a quantity that has both magnitude (size) and direction
16. a fictitious force that acts perpendicular to the velocity of an object in a rotating frame of reference (two words)
20. a force that acts between two objects when they touch each other (two words)
23. a force that resists attempted motion between two surfaces in contact (two words)
26. the velocity of an object at a particular instant; the slope of the tangent to a position-time graph (two words)
27. a force exerted by objects that can be stretched
30. the net force that causes centripetal acceleration (two words)
31. the time required for a rotating, revolving, or vibrating object to complete one cycle
32. a device that converts energy into linear motion (two words)
34. a push or a pull
37. a quantity that has magnitude (size) but no direction
40. the total distance travelled divided by the total time to travel that distance (two words)
41. the ratio of kinetic friction to the normal force (four words)
44. the friction between objects and the air around them (two words)
45. a force exerted on a moving object by a surface in the direction of motion opposite to the motion of the object (two words)
47. the SI unit of force
48. a rapidly rotating device used to separate substances and simulate the effects of gravity
49. a force perpendicular to the surface between objects in contacts (two words)
51. a force due to one object pushing or pulling on another (two words)
52. the motion of an object with a constant speed along a circular path of constant radius (three words)
53. a measure of the amount of matter in an object
54. the change in velocity divided by the time interval for that change (two words)

Down

2. the magnitude of the normal force acting on an object in an accelerated (non-inertial) frame of reference (two words)
3. a straight line that intersects a curve at a point and has the same slope as the curve at the point of intersection
5. a coordinate system relative to which motion is described or observed (three words)
6. the change in position divided by the time interval
8. the speed of an object at a particular instant; the magnitude of the slope of the tangent to a position-time graph (two words)
10. a simple line drawing that shows all the forces acting on an object (two words)
11. an apparent but non-existent force invented to explain the motion of objects within an accelerating (non-inertial) frame of reference (two words)
12. the acceleration at a particular instant in time (two words)
17. the velocity of an object relative to a specific frame of reference (two words)
18. a state in which an object has no net force acting on it
19. a force that acts between two objects without the objects touching; also called action-at-a-distance force (two words)
21. the straight-line distance and direction of an object from a reference point
22. the instantaneous acceleration that is directed toward the centre of a circular path (two words)
24. the ratio of the maximum force of static friction to the normal force (four words)
25. a frame of reference that accelerates with respect to an inertial frame; the law of inertia does not hold (four words)
28. the change in position of an object
29. the number of rotations, revolutions, or vibrations of an object per unit of time; the inverse of period
30. in two dimensions, either of the x-vector and y-vector that are combined into an overall vector (four words)
31. the motion of a projectile such that the horizontal component of the velocity is constant, and the vertical motion has a constant acceleration due to gravity (two words)
33. the displacement divided by the time interval for that change; the slope of a secant on a position-time graph (two words)
35. the study of the causes of motion
36. the fictitious force in a rotating (accelerating or non-inertial) frame of reference (two words)
38. a coordinate system relative to which motion is described or observed (three words)
39. a force that opposes the sliding of two surfaces across one another; acts opposite to motion or attempted motion
42. an object that is launched through the air along a parabolic trajectory and accelerates due to gravity
43. the study of motion without considering the forces that produce the motion
46. the sum of all the forces acting on an object (two words)
50. the horizontal displacement of a projectile

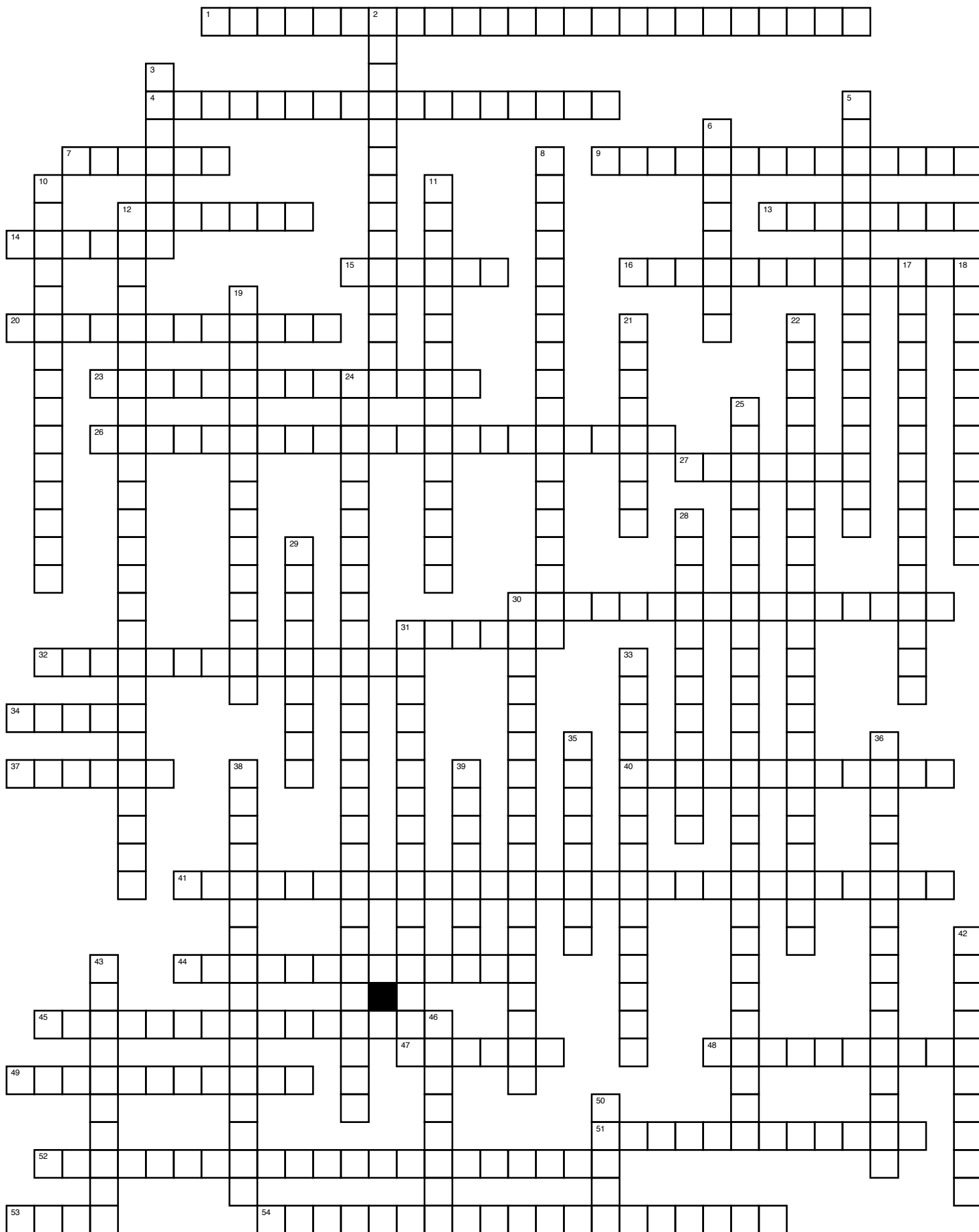




Image © Wikimedia Commons. Used under Creative Commons license.

Chapter 1

Kinematics

- ▶ the study of motion without considering the forces that produce the motion
- ▶ the study of the causes of motion
- ▶ a quantity that has magnitude (size) but no direction
- ▶ a quantity that has both magnitude (size) and direction
- ▶ the straight-line distance and direction of an object from a reference point
- ▶ the change in position of an object
- ▶ the total distance travelled divided by the total time to travel that distance (two words)
- ▶ the change in position divided by the time interval
- ▶ the displacement divided by the time interval for that change; the slope of a secant on a position-time graph (two words)
- ▶ a straight line connecting two separate points on a curve
- ▶ a straight line that intersects a curve at a point and has the same slope as the curve at the point of intersection
- ▶ the velocity of an object at a particular instant; the slope of the tangent to a position-time graph (two words)
- ▶ the speed of an object at a particular instant; the magnitude of the slope of the tangent to a position-time graph (two words)
- ▶ the change in velocity divided by the time interval for that change (two words)
- ▶ the acceleration at a particular instant in time (two words)
- ▶ the motion of a falling object where the only force acting on
- ▶ in two dimensions, either of the x-vector and y-vector that are combined into an overall vector (four words)
- ▶ an object that is launched through the air along a parabolic trajectory and accelerates due to gravity
- ▶ the horizontal displacement of a projectile
- ▶ the motion of a projectile such that the horizontal component of the velocity is constant, and the vertical motion has a constant acceleration due to gravity (two words)
- ▶ a coordinate system relative to which motion is described or observed (three words)
- ▶ the velocity of an object relative to a specific frame of reference (two words)

R	R	N	I	F	K	Y	P	S	V	S	B	A	U	O	A	U	C	E	Q	W	D	H	G
X	I	A	K	J	H	E	C	N	E	W	D	Q	P	E	U	K	R	A	L	A	C	S	B
O	L	B	U	R	V	I	O	C	V	T	E	F	G	C	G	V	Z	Y	G	M	B	N	C
I	W	O	N	H	M	X	A	Y	E	Y	F	Z	Y	N	T	A	N	G	E	N	T	O	Y
W	T	D	M	A	K	N	N	Z	L	N	L	Q	T	E	B	P	P	N	V	Z	C	I	T
I	Z	E	N	O	T	L	I	F	O	H	G	J	B	R	T	M	I	Z	R	I	O	T	I
F	N	Y	W	M	Q	P	N	S	C	Q	P	A	U	E	N	I	C	I	E	J	K	A	C
B	D	S	W	N	E	L	S	U	I	H	F	J	J	F	E	L	M	M	L	C	M	R	O
O	E	V	T	M	D	H	T	W	T	E	H	I	A	E	M	F	G	R	A	F	Q	E	L
L	E	K	N	A	P	A	A	N	Y	P	R	E	X	R	E	R	B	X	T	W	S	L	E
Q	P	I	Y	D	N	R	N	K	M	Z	D	N	D	F	C	E	O	U	I	E	P	E	V
M	S	N	I	O	U	T	T	D	N	O	F	O	U	O	A	E	G	F	V	S	G	C	E
C	E	S	R	S	O	P	A	V	O	J	W	V	Z	E	L	F	O	A	E	Y	Z	C	G
Q	G	T	O	T	E	R	N	N	T	X	Y	K	C	M	P	A	Z	U	V	J	I	A	A
D	A	A	T	T	G	O	E	Q	E	E	F	D	U	A	S	L	K	P	E	Q	V	E	R
W	R	N	C	S	N	J	O	V	M	O	P	G	V	R	I	L	K	J	L	E	W	G	E
V	E	T	E	A	A	E	U	Q	N	S	U	L	H	F	D	R	Z	S	O	J	V	A	V
A	V	A	V	I	R	C	S	L	B	V	C	S	E	D	I	B	C	M	C	T	E	R	A
L	A	N	A	K	Q	T	A	R	I	Y	A	J	V	V	O	I	V	D	I	M	L	E	Z
R	R	E	F	G	V	I	C	S	G	L	N	X	M	E	T	E	S	G	T	O	I	V	K
G	M	O	O	F	H	L	C	Q	C	N	E	H	P	A	L	F	J	Q	Y	R	T	A	C
Y	P	U	T	N	E	E	E	A	E	O	X	F	M	P	Z	O	M	U	V	M	C	W	R
T	S	S	N	R	L	M	L	B	R	I	S	E	L	J	R	A	C	I	B	F	E	P	X
Z	V	S	E	O	B	O	E	S	E	T	N	M	Z	R	H	L	L	I	W	L	J	J	D
I	A	P	N	T	M	T	R	D	U	I	L	R	V	Q	H	Z	O	U	T	U	O	B	T
I	Y	E	O	C	B	I	A	X	K	S	B	U	F	J	D	H	O	W	I	Y	R	G	G
X	H	E	P	E	D	O	T	Y	R	O	K	J	U	P	C	R	N	I	D	Q	P	X	Y
O	W	D	M	V	O	N	I	N	U	P	H	L	C	S	K	M	S	N	A	E	C	Y	H
S	J	Q	O	O	F	J	O	N	K	P	O	A	K	C	L	K	Z	J	T	K	R	Y	Z
E	V	W	C	D	G	N	N	L	W	T	Z	C	Z	M	Q	N	I	H	P	P	P	M	W



Chapter 2

Dynamics

- ▶ a push or a pull
- ▶ the SI unit of force
- ▶ a force that acts between two objects when they touch each other (two words)
- ▶ a force that acts between two objects without the objects touching; also called action-at-a-distance force (two words)
- ▶ the force of attraction between all objects due to mass (three words)
- ▶ a force perpendicular to the surface between objects in contacts (two words)
- ▶ a force exerted by objects that can be stretched
- ▶ a force that opposes the sliding of two surfaces across one another; acts opposite to motion or attempted motion
- ▶ a force that resists attempted motion between two surfaces in contact (two words)
- ▶ a force exerted on a moving object by a surface in the direction of motion opposite to the motion of the object (two words)
- ▶ the friction between objects and the air around them (two words)
- ▶ a force due to one object pushing or pulling on another (two words)
- ▶ a simple line drawing that shows all the forces acting on an object (two words)
- ▶ the sum of all the forces acting on an object (two words)
- ▶ a measure of an object's resistance to change in velocity
- ▶ a measure of the amount of matter in an object
- ▶ the gravitational force exerted by Earth on an object
- ▶ a state in which an object has no net force acting on it
- ▶ the ratio of kinetic friction to the normal force (four words)
- ▶ the ratio of the maximum force of static friction to the normal force (four words)
- ▶ a device that converts energy into linear motion (two words)

T	J	A	A	M	A	R	G	A	I	D	Y	D	O	B	E	E	R	F	V	L	C	E	Y
Z	N	V	C	J	J	J	Y	E	Y	N	O	T	W	E	N	D	M	P	U	M	H	I	P
H	O	T	S	U	F	M	K	W	C	D	O	C	K	J	I	K	I	J	J	A	M	U	Z
Z	I	M	B	O	H	F	G	I	U	R	E	O	O	B	U	I	P	N	K	S	X	Y	J
R	T	S	C	O	Y	B	Q	Y	N	X	O	E	U	B	L	Y	I	S	T	S	G	N	L
F	C	N	W	Z	S	T	W	M	A	E	C	F	S	U	I	J	U	B	H	G	O	O	U
O	I	O	M	N	P	X	C	C	B	A	T	F	L	K	W	D	O	I	M	I	Y	N	L
R	R	I	U	M	T	S	Z	V	K	Y	R	I	S	A	A	K	M	Z	T	D	B	E	P
C	F	S	I	V	H	H	G	V	S	S	H	C	C	A	M	D	X	C	T	Z	M	X	L
E	C	N	R	S	G	C	S	M	O	B	P	I	F	F	F	R	I	R	X	P	H	Q	R
O	I	E	B	L	I	F	T	B	E	B	M	E	T	K	R	R	O	Z	H	S	K	B	H
F	T	T	I	A	E	Q	C	M	C	C	O	N	T	Z	F	I	Z	N	N	E	U	N	R
G	A	Z	L	B	W	G	K	A	I	I	R	T	U	V	C	G	C	A	B	P	X	J	I
R	T	C	I	C	W	R	B	N	R	G	Y	O	T	O	W	B	Y	T	V	M	V	H	X
A	S	V	U	K	R	V	E	S	Q	R	X	F	F	K	S	K	O	D	I	V	V	N	M
V	F	N	Q	Y	I	R	X	C	S	I	W	K	D	Z	N	J	O	S	L	O	U	S	H
I	O	O	E	Z	T	V	Q	O	O	K	C	I	Y	U	S	X	H	H	K	O	N	B	B
T	T	I	C	I	O	H	I	X	Q	D	W	N	U	G	N	W	Y	G	O	H	Q	H	C
Y	N	T	A	D	P	R	R	V	N	L	K	E	C	N	G	Z	D	F	H	W	E	Z	O
O	E	C	F	G	B	N	O	N	C	O	N	T	A	C	T	F	O	R	C	E	O	U	N
Q	I	I	E	M	J	P	M	R	P	Q	H	I	T	G	S	P	N	P	B	A	E	O	T
S	C	R	J	L	O	M	D	R	I	B	L	C	K	B	E	F	B	E	Z	N	U	C	A
M	I	F	Q	C	H	R	O	M	K	T	A	F	L	M	I	O	V	W	E	Y	R	U	C
G	F	C	Q	R	O	T	A	U	T	C	A	R	A	E	N	I	L	F	A	F	M	I	T
X	F	I	W	K	O	T	V	D	V	L	L	I	L	J	V	G	A	V	O	R	A	K	F
B	E	T	B	N	E	T	F	O	R	C	E	C	C	C	S	A	H	H	F	X	F	H	O
Q	O	A	D	G	J	F	M	E	C	N	A	T	S	I	S	E	R	R	I	A	R	U	R
F	C	T	T	X	A	J	P	V	C	F	H	I	T	V	K	F	A	Y	H	W	F	J	C
Y	B	S	J	U	N	G	F	J	X	Z	X	O	V	C	T	Q	H	P	H	Q	H	O	E
E	C	R	O	F	D	E	I	L	P	P	A	N	R	O	N	J	D	O	F	P	M	F	O



Image © Michael Osmenda. Used under Creative Commons license

Chapter 3

Uniform Circular Motion

- ▶ a coordinate system relative to which motion is described or observed (three words)
- ▶ a frame of reference that moves at a zero or constant velocity; the law of inertia holds (four words)
- ▶ a frame of reference that accelerates with respect to an inertial frame; the law of inertia does not hold (four words)
- ▶ an apparent but non-existent force invented to explain the motion of objects within an accelerating (non-inertial) frame of reference (two words)
- ▶ the magnitude of the normal force acting on an object in an accelerated (non-inertial) frame of reference (two words)
- ▶ the motion of an object with a constant speed along a circular path of constant radius (three words)
- ▶ the instantaneous acceleration that is directed toward the centre of a circular path (two words)
- ▶ the time required for a rotating, revolving, or vibrating object to complete one cycle
- ▶ the number of rotations, revolutions, or vibrations of an object per unit of time; the inverse of period
- ▶ the net force that causes centripetal acceleration (two words)
- ▶ a rapidly rotating device used to separate substances and simulate the effects of gravity
- ▶ the fictitious force in a rotating (accelerating or non-inertial) frame of reference (two words)
- ▶ a fictitious force that acts perpendicular to the velocity of an object in a rotating frame of reference (two words)
- ▶ a situation in which the value of gravity has been changed artificially to more closely match Earth's gravity (two words)

H	D	H	V	Q	I	T	K	W	J	M	M	M	V	Z	Q	R	R	E	H	I	Y	G	O
E	U	C	M	N	N	P	O	L	W	Q	B	T	B	B	T	U	I	C	S	Z	L	W	N
C	W	F	T	D	E	M	B	Z	T	H	G	I	E	W	T	N	E	R	A	P	P	A	M
N	R	X	F	O	R	U	E	V	G	S	U	N	W	S	P	P	Q	O	U	C	T	F	O
E	Y	E	U	I	T	Z	K	U	H	R	N	T	T	O	R	L	T	F	E	E	L	K	X
R	S	L	K	R	I	H	N	T	R	O	I	T	M	V	J	N	R	S	P	A	I	L	H
E	F	U	E	E	A	R	O	S	O	C	F	Q	R	O	O	X	F	U	J	P	C	W	U
F	Q	W	W	P	L	J	I	E	P	I	O	G	E	H	O	J	X	O	O	A	B	N	E
E	C	C	A	O	F	M	T	L	H	G	R	A	C	Y	I	A	A	I	S	Y	S	Y	C
R	E	K	B	S	R	I	A	M	X	P	M	V	R	Z	X	C	B	T	S	Z	Y	M	N
F	N	C	I	Y	A	K	R	D	N	O	C	M	O	K	H	D	Z	I	A	L	T	M	E
O	T	T	A	G	M	V	E	K	Y	I	I	B	F	J	Z	U	E	T	H	H	I	O	R
E	R	J	C	Z	E	H	L	C	W	Q	R	V	S	F	S	P	G	C	U	Z	V	S	E
M	I	B	C	Z	O	G	E	E	D	J	C	W	I	M	A	U	U	I	E	K	A	A	F
A	P	K	E	G	F	J	C	N	J	F	U	J	L	Z	U	F	U	F	W	J	R	R	E
R	E	A	E	P	R	P	C	T	G	W	L	S	O	W	M	X	D	F	K	M	G	P	R
F	T	E	H	C	E	G	A	R	C	Z	A	R	I	O	Q	Z	X	I	W	V	L	N	F
L	A	W	K	Z	F	D	L	I	P	U	R	H	R	H	E	T	Y	L	J	I	A	C	O
A	L	J	I	K	E	S	A	F	I	O	M	F	O	Z	V	F	A	H	F	L	I	P	E
I	F	E	O	X	R	F	T	U	B	Y	O	P	C	J	L	X	Q	A	V	C	C	X	M
T	O	M	S	L	E	M	E	G	Q	G	T	G	G	T	X	R	V	G	C	O	I	E	A
R	R	D	L	Z	N	Y	P	E	V	M	I	L	R	Q	V	L	P	L	M	A	F	W	R
E	C	U	P	G	C	J	I	A	X	W	O	N	O	N	R	V	Y	Q	Z	L	I	N	F
N	E	C	T	W	E	B	R	Z	Y	Q	N	F	P	T	G	P	A	J	P	I	T	K	T
I	L	V	O	D	S	P	T	Q	W	K	A	L	X	F	J	P	W	M	N	W	R	V	Q
N	X	Z	E	S	C	E	N	T	R	I	F	U	G	A	L	F	O	R	C	E	A	N	W
O	M	C	S	Y	C	N	E	U	Q	E	R	F	Z	U	X	C	M	U	O	J	Y	X	E
N	D	D	F	X	T	A	C	E	F	T	O	K	E	S	X	K	A	V	L	G	W	T	Z
P	G	Q	P	U	B	K	J	Q	A	H	Y	G	U	R	D	N	C	Z	J	L	V	F	Y
A	G	M	T	Q	Q	Y	Z	M	C	U	E	C	J	W	J	U	R	N	O	X	X	O	N



Unit 1

Dynamics

- ▶ the study of motion without considering the forces that produce the motion
- ▶ the study of the causes of motion
- ▶ a quantity that has magnitude (size) but no direction
- ▶ a quantity that has both magnitude (size) and direction
- ▶ the straight-line distance and direction of an object from a reference point
- ▶ the change in position of an object
- ▶ the total distance travelled divided by the total time to travel that distance (two words)
- ▶ the change in position divided by the time interval
- ▶ the displacement divided by the time interval for that change; the slope of a secant on a position-time graph (two words)
- ▶ a straight line connecting two separate points on a curve
- ▶ a straight line that intersects a curve at a point and has the same slope as the curve at the point of intersection
- ▶ the velocity of an object at a particular instant; the slope of the tangent to a position-time graph (two words)
- ▶ the speed of an object at a particular instant; the magnitude of the slope of the tangent to a position-time graph (two words)
- ▶ the change in velocity divided by the time interval for that change (two words)
- ▶ the acceleration at a particular instant in time (two words)
- ▶ the motion of a falling object where the only force acting on the object is gravity (two words)
- ▶ in two dimensions, either of the x-vector and y-vector that are combined into an overall vector (four words)
- ▶ an object that is launched through the air along a parabolic trajectory and accelerates due to gravity
- ▶ the horizontal displacement of a projectile
- ▶ the motion of a projectile such that the horizontal component of the velocity is constant, and the vertical motion has a constant acceleration due to gravity (two words)
- ▶ a coordinate system relative to which motion is described or observed (three words)
- ▶ the velocity of an object relative to a specific frame of reference (two words)
- ▶ a push or a pull
- ▶ the SI unit of force
- ▶ a force that acts between two objects when they touch each other (two words)
- ▶ a force that acts between two objects without the objects touching; also called action-at-a-distance force (two words)
- ▶ the force of attraction between all objects due to mass (three words)
- ▶ a force perpendicular to the surface between objects in contacts (two words)
- ▶ a force exerted by objects that can be stretched
- ▶ a force that opposes the sliding of two surfaces across one another; acts opposite to motion or attempted motion
- ▶ a force that resists attempted motion between two surfaces in contact (two words)
- ▶ a force exerted on a moving object by a surface in the direction of motion opposite to the motion of the object (two words)
- ▶ the friction between objects and the air around them (two words)
- ▶ a force due to one object pushing or pulling on another (two words)
- ▶ a simple line drawing that shows all the forces acting on an object (two words)
- ▶ the sum of all the forces acting on an object (two words)
- ▶ a measure of an object's resistance to change in velocity
- ▶ a measure of the amount of matter in an object
- ▶ the gravitational force exerted by Earth on an object
- ▶ a state in which an object has no net force acting on it
- ▶ the ratio of kinetic friction to the normal force (four words)
- ▶ the ratio of the maximum force of static friction to the normal force (four words)
- ▶ a device that converts energy into linear motion (two words)
- ▶ a coordinate system relative to which motion is described or observed (three words)
- ▶ a frame of reference that moves at a zero or constant velocity; the law of inertia holds (four words)
- ▶ a frame of reference that accelerates with respect to an inertial frame; the law of inertia does not hold (four words)
- ▶ an apparent but non-existent force invented to explain the motion of objects within an accelerating (non-inertial) frame of reference (two words)
- ▶ the magnitude of the normal force acting on an object in an accelerated (non-inertial) frame of reference (two words)
- ▶ the motion of an object with a constant speed along a circular path of constant radius (three words)
- ▶ the instantaneous acceleration that is directed toward the centre of a circular path (two words)
- ▶ the time required for a rotating, revolving, or vibrating object to complete one cycle
- ▶ the number of rotations, revolutions, or vibrations of an object per unit of time; the inverse of period
- ▶ the net force that causes centripetal acceleration (two words)
- ▶ a rapidly rotating device used to separate substances and simulate the effects of gravity
- ▶ the fictitious force in a rotating (accelerating or non-inertial) frame of reference (two words)
- ▶ a fictitious force that acts perpendicular to the velocity of an object in a rotating frame of reference (two words)
- ▶ a situation in which the value of gravity has been changed artificially to more closely match Earth's gravity (two words)

B	L	W	E	C	R	O	F	S	I	L	O	I	R	O	C	B	T	A	K	I	N	E	T	I	C	F	R	I	C	T	I	O	N	H
U	U	K	C	M	C	S	C	Q	E	B	R	P	R	O	J	E	C	T	I	L	E	T	H	G	I	E	W	G	Z	V	H	X	D	O
A	P	R	X	X	U	D	G	D	J	L	O	R	O	T	A	U	T	C	A	R	A	E	N	I	L	Y	P	B	Y	T	M	I	X	N
E	N	N	I	X	C	T	H	M	D	B	W	V	B	A	U	Y	L	Y	W	L	D	Q	C	M	A	C	J	Z	K	N	T	N	P	R
O	K	U	G	V	J	V	A	C	C	P	P	J	A	P	A	F	D	C	Y	Y	T	I	C	O	L	E	V	E	G	A	R	E	V	A
R	M	I	R	O	T	C	E	V	M	S	Q	Y	D	E	E	P	S	E	G	A	R	E	V	A	G	Q	M	M	I	C	D	R	F	N
R	Q	D	H	J	T	U	T	Y	R	Y	Q	H	J	V	D	Z	P	R	I	Y	X	S	L	I	J	I	L	L	P	E	G	T	Z	O
D	B	Q	D	U	C	C	F	K	E	X	W	L	P	I	I	P	Q	Q	J	E	E	I	I	X	W	C	T	M	C	S	W	I	H	I
C	E	Z	N	O	N	I	N	E	R	T	I	A	L	F	R	A	M	E	O	F	R	E	F	E	R	E	N	C	E	S	C	A	P	T
C	Z	C	U	U	X	T	Y	B	X	L	K	C	J	X	T	T	U	X	Y	B	A	I	D	F	Q	D	H	X	O	I	C	U	R	C
Y	L	W	E	D	K	U	Q	J	A	N	O	I	T	C	I	R	F	C	I	T	A	T	S	N	M	X	P	X	R	E	F	Y	B	I
X	C	N	S	N	V	D	Z	H	Q	T	N	E	M	E	C	A	L	P	S	I	D	I	O	I	E	A	W	O	N	Z	Q	L	B	R
S	O	Y	A	N	T	E	T	Y	V	E	E	I	X	D	E	E	P	S	S	U	O	E	N	A	T	N	A	T	S	N	I	D	V	F
G	M	T	Q	O	W	R	N	U	K	T	R	E	C	B	R	A	P	J	R	L	I	G	I	J	X	M	R	V	F	J	Q	T	C	C
W	P	I	D	I	D	U	I	L	T	C	E	A	I	I	C	J	X	J	M	Y	H	H	P	Z	S	I	V	R	M	O	A	O	R	I
A	O	C	V	T	V	M	R	P	R	Z	Z	C	S	C	D	F	D	O	E	S	L	F	X	L	F	G	A	X	Y	N	E	G	A	T
X	N	O	E	O	A	U	T	S	E	E	F	Z	N	C	E	F	T	O	M	M	E	E	T	U	Y	M	T	I	G	F	D	F	L	A
M	E	L	X	M	P	C	Z	I	J	T	Z	O	R	E	U	N	U	W	O	Y	O	K	G	N	E	G	H	K	F	P	Y	Z	A	T
E	N	E	O	E	P	E	N	L	R	C	A	S	R	E	R	F	T	G	Z	M	K	E	V	O	H	A	W	I	T	H	O	J	C	S
O	T	V	A	L	L	N	N	W	P	L	C	L	W	C	I	E	P	R	E	I	W	F	F	E	V	S	C	D	Q	N	M	A	S	F
V	O	E	G	I	I	T	W	I	J	Y	N	M	A	C	E	L	F	M	I	T	Q	R	B	E	L	I	C	J	D	U	R	U	K	O
A	F	V	S	T	E	R	D	N	T	E	D	M	T	C	A	O	U	E	H	P	E	Z	R	N	E	O	C	O	I	K	N	I	O	T
I	A	I	T	C	D	I	X	X	O	H	H	I	P	F	C	W	F	G	R	F	E	A	X	N	U	O	C	R	Q	I	F	N	G	N
R	V	T	N	E	F	F	F	W	C	R	T	V	L	Q	O	E	I	G	E	F	G	T	T	O	J	I	B	I	F	T	R	S	R	E
R	E	A	D	J	O	U	L	D	B	I	M	C	U	Y	C	E	L	R	E	O	O	A	W	G	I	W	O	T	L	E	T	Y	I	
E	C	L	U	O	R	G	V	T	O	T	I	A	T	W	W	O	E	E	A	A	F	E	B	L	L	Y	R	S	R	Y	Q	A	W	C
S	T	E	J	R	C	A	X	U	O	X	S	D	L	T	J	N	N	C	R	K	V	F	M	I	F	M	K	T	K	I	U	N	X	I
I	O	R	U	P	E	L	S	O	R	P	Q	C	N	F	C	H	C	T	I	A	O	I	U	A	C	O	A	Y	X	V	E	T	K	F
S	R	W	U	N	H	F	F	N	X	C	A	E	I	E	O	E	H	N	A	R	T	Q	T	I	R	J	R	I	Z	X	N	A	B	F
T	U	O	M	K	O	O	K	X	X	O	R	T	R	T	L	R	E	O	C	C	E	I	R	Y	O	F	F	C	A	H	C	N	H	E
A	Q	P	D	R	T	R	D	E	H	A	G	E	N	E	A	T	C	E	X	J	T	C	O	D	J	V	L	U	E	A	Y	E	Z	O
N	Z	I	C	N	B	C	O	W	P	S	P	P	R	E	I	M	P	E	Y	M	U	F	O	N	Q	Q	O	A	P	H	Z	O	V	C
C	J	E	P	U	T	E	E	P	Y	V	N	A	C	C	G	L	E	B	U	L	X	I	O	N	T	C	C	S	I	O	K	U	D	I
E	S	Z	F	A	Z	Y	A	Q	M	E	T	W	F	X	J	N	B	N	A	D	R	M	W	R	O	A	K	F	S	T	A	S	S	Q
J	E	E	R	O	I	U	C	Y	T	I	O	R	J	N	J	N	A	R	I	E	Q	G	V	M	C	T	Z	Q	C	A	R	V	C	A
D	Y	C	I	D	V	S	K	F	O	F	I	F	J	T	Y	T	M	T	P	K	C	G	M	C	B	E	W	Z	I	I	M	E	Z	P
Y	B	V	C	W	G	X	O	N	D	C	M	A	P	W	Z	O	X	Q	O	T	K	P	O	E	O	I	P	E	I	M	T	L	N	I
N	W	A	T	B	O	R	J	X	T	V	I	E	C	N	T	J	M	N	O	I	T	I	S	O	P	F	B	Z	N	P	R	O	X	I
A	P	K	I	B	C	W	R	I	A	N	A	R	T	I	F	I	C	I	A	L	G	R	A	V	I	T	Y	J	G	S	M	C	B	P
M	A	I	O	E	T	A	O	Y	C	M	F	X	O	T	E	N	S	I	O	N	L	M	C	W	J	Q	S	F	V	S	I	I	T	P
I	Y	T	N	Z	N	N	H	G	V	E	C	N	E	R	E	F	E	R	F	O	E	M	A	R	F	O	X	G	K	P	D	T	W	G
C	R	H	E	G	M	C	P	N	I	N	T	Y	S	P	X	E	C	R	O	F	T	C	A	T	N	O	C	N	O	N	H	Y	O	T
S	V	V	E	W	K	U	F	R	E	E	B	O	D	Y	D	I	A	G	R	A	M	C	Q	B	F	R	E	E	F	A	L	L	C	B
N	N	O	Q	K	U	I	N	S	T	A	N	T	A	N	E	O	U	S	A	C	C	E	L	E	R	A	T	I	O	N	Z	R	X	V

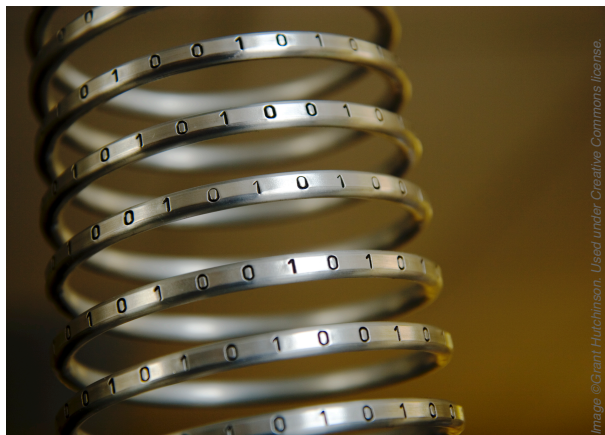


Image © Grant Hutchison. Used under Creative Commons license.

Chapter 4

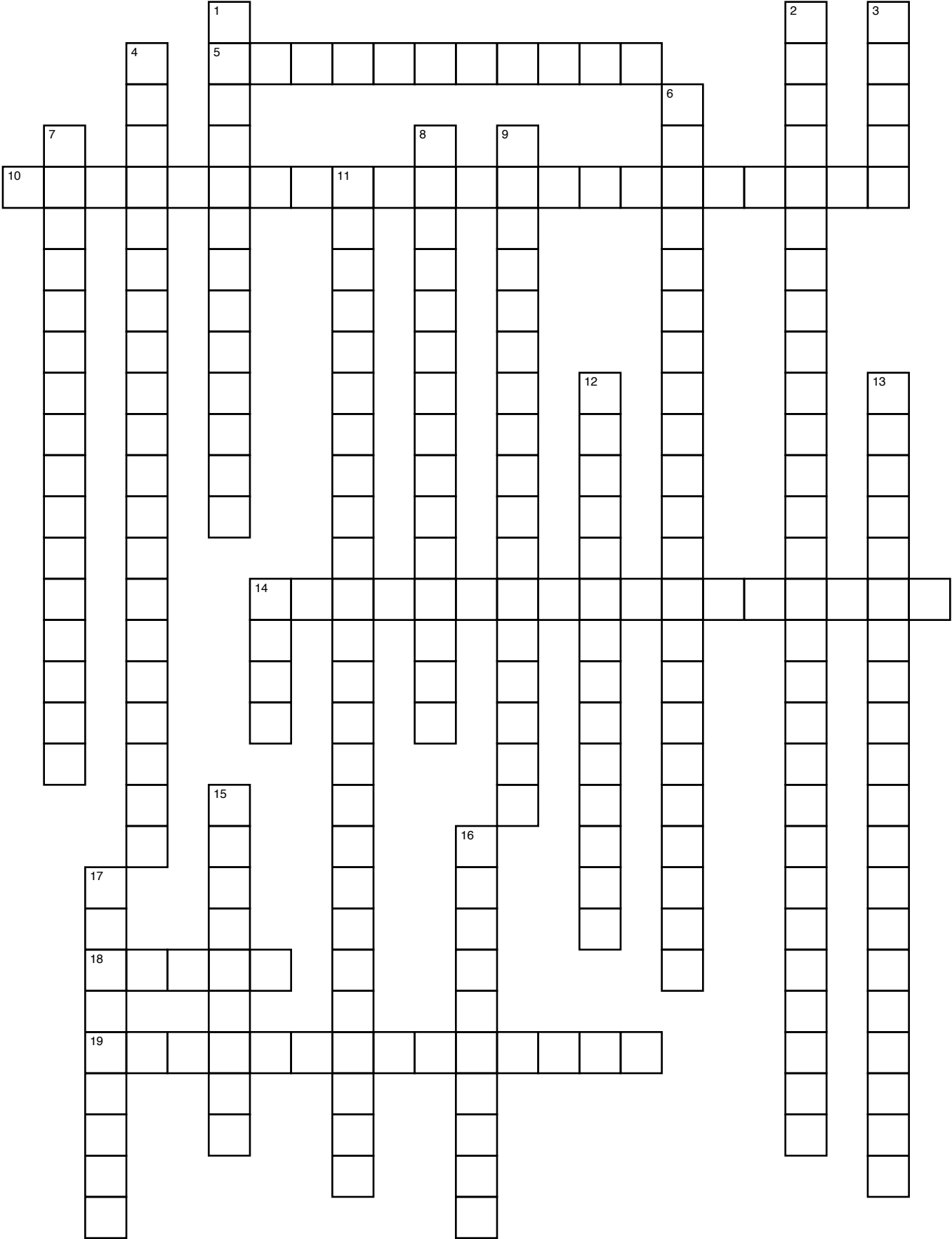
Work and Energy

Across

5. any spring that obey's Hooke's law; it does not experience any internal or external friction (two words)
10. a machine that can operate forever without restarting or refueling (three words)
14. the total work done on an object equals the change in its kinetic energy (two words)
18. the rate of work done by a force over time, or the rate at which the energy of an open system changes
19. a system that cannot interact or exchange energy with external systems; also called a closed system (two words)

Down

1. the energy an object has because of its motion (two words)
2. stored energy an object has because of its position and the applied gravitational force (three words)
3. the SI unit of work and energy
4. periodic motion affected by friction (three words)
6. the potential energy due to the stretching or compressing of an elastic material (three words)
7. the sum of an object's kinetic and potential energies (two words)
8. the stored energy an object has that can be converted into another form of energy (two words)
9. a type of chemical potential energy stored in the cells and other basic structures of biological organisms (two words)
11. energy is neither created nor destroyed, it can only change form (five words)
12. the constant of variation between the force exerted by an ideal spring and the spring's displacement (two words)
13. periodic motion in which the acceleration of the moving object is proportional to its displacement (three words)
14. the product of the magnitude of an object's displacement and the component of the applied force in the direction of displacement
15. the amount of force exerted by a spring is directly proportional to the displacement of the spring (two words)
16. a system that can interact with another external system (two words)
17. the maximum displacement of a wave



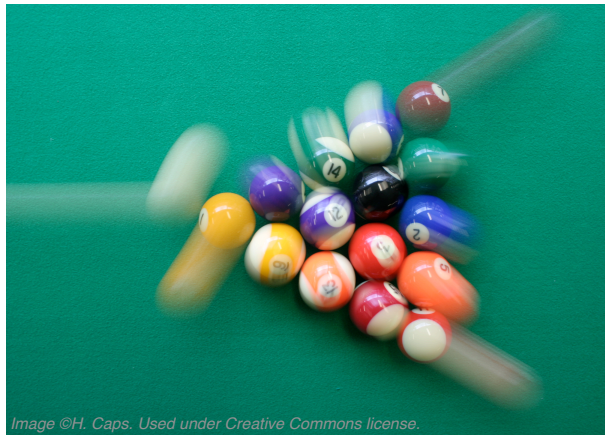


Image ©H. Caps. Used under Creative Commons license.

Chapter 5

Momentum and Collisions

Across

3. a quantity that describes the motion of an object travelling in a straight line as the product of its mass and velocity (two words)
6. the product of force and time that acts on an object to produce a change in momentum
7. a collision in which momentum and kinetic energy are conserved (two words)
8. an impact in which two objects approach each other from opposite directions; momentum and kinetic energy are conserved after the collision (three words)
9. a collision in which the first object, after an impact with the second object, travels at an angle to the direction it was originally travelling (two words)
10. the impact of one body on another

Down

1. an ideal collision in which two objects stick together perfectly so they have the same final velocity; in this situation, momentum is perfectly conserved, but kinetic energy is not conserved (three words)
2. the total kinetic energy of two objects before a collision is equal to the total kinetic energy of the two objects after the collision (four words)
4. an ideal collision in which external forces are minimized to the point where momentum and kinetic energy are perfectly conserved (three words)
5. a collision in which momentum is conserved, but kinetic energy is not conserved (two words)

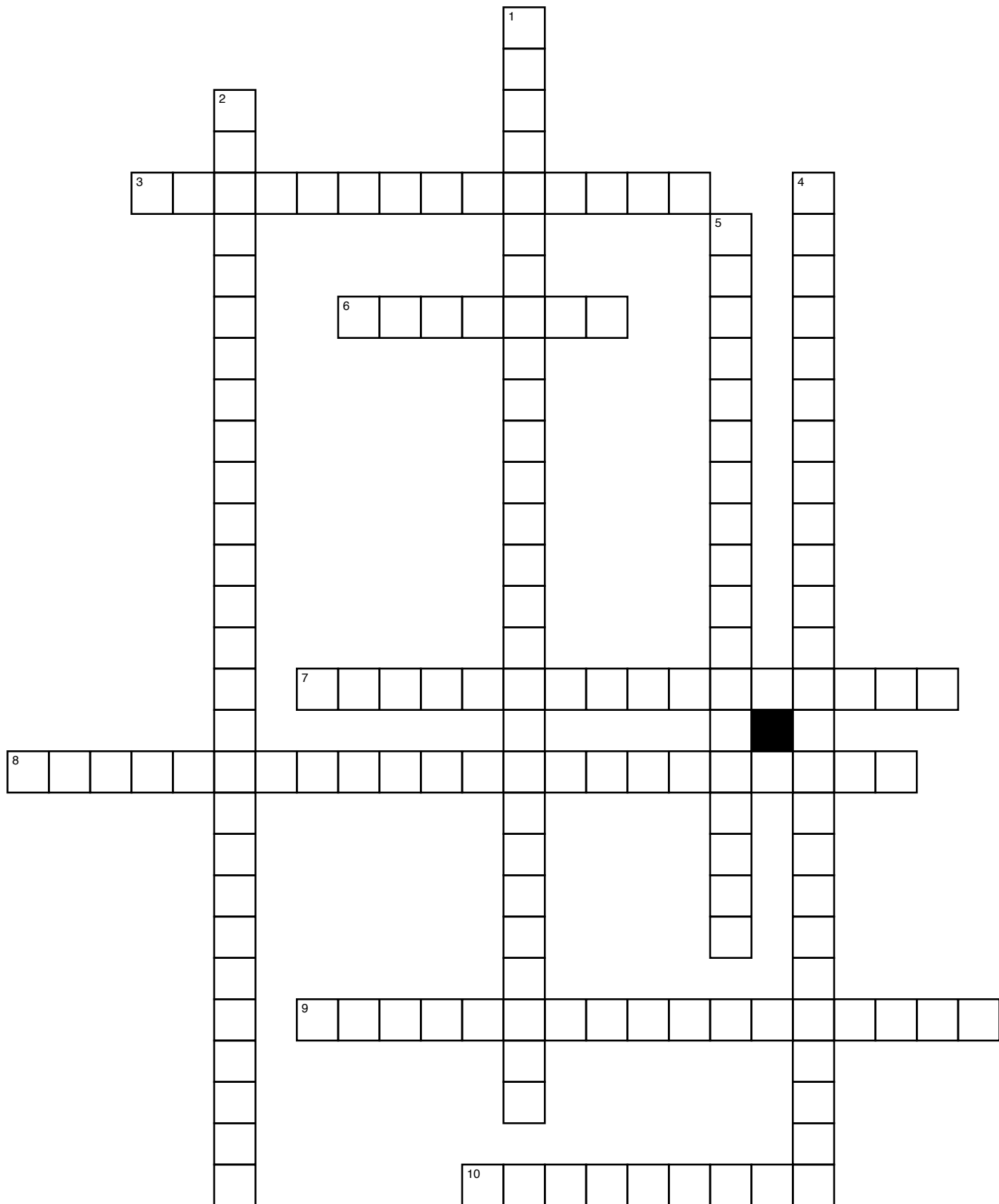




Image ©Andrzej Barabasz. Used under Creative Commons license.

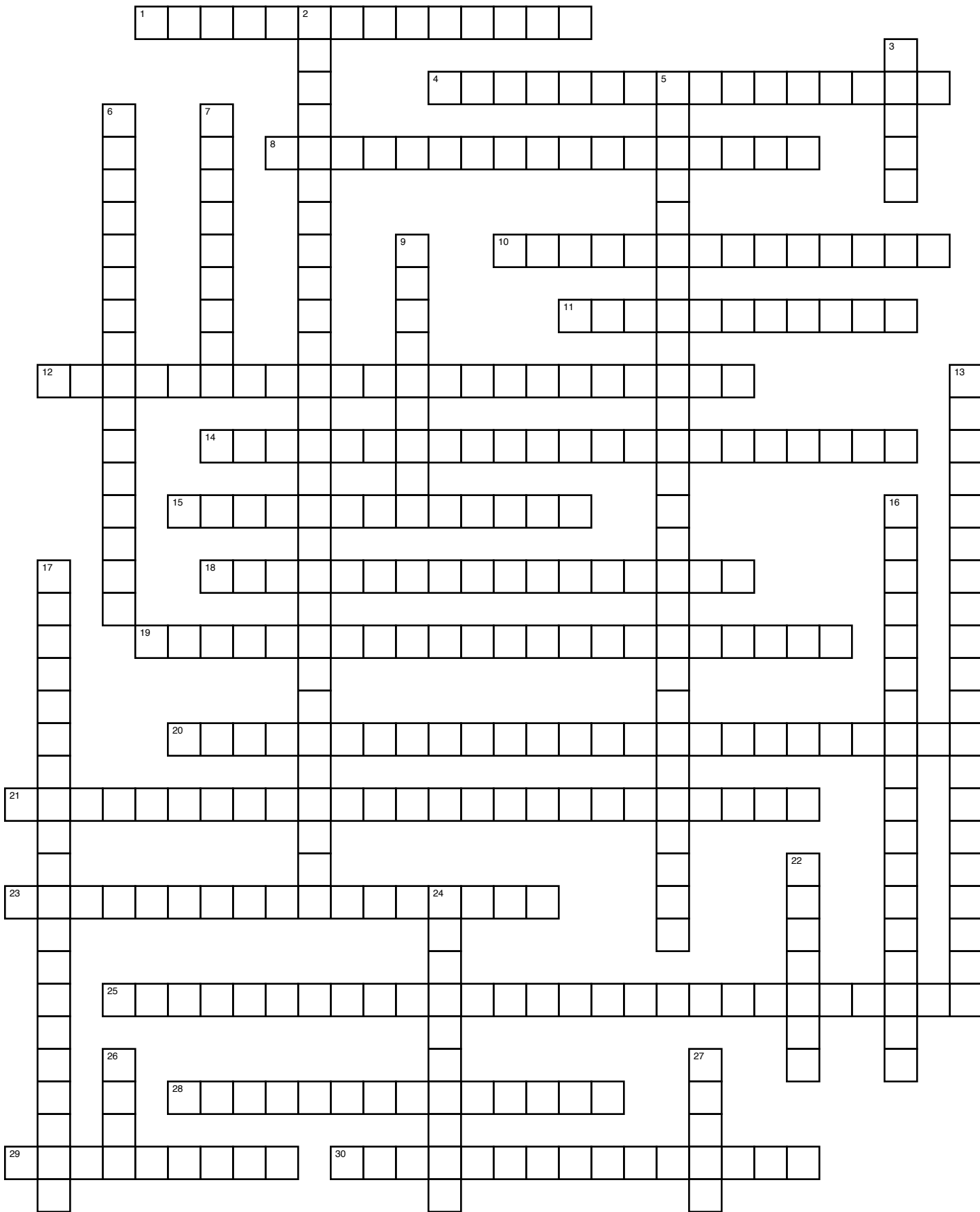
Unit 2 Energy and Momentum

Across

1. the constant of variation between the force exerted by an ideal spring and the spring's displacement (two words)
4. a collision in which momentum and kinetic energy are conserved (two words)
8. a type of chemical potential energy stored in the cells and other basic structures of biological organisms (two words)
10. a quantity that describes the motion of an object travelling in a straight line as the product of its mass and velocity (two words)
11. any spring that obeys Hooke's law; it does not experience any internal or external friction (two words)
12. an impact in which two objects approach each other from opposite directions; momentum and kinetic energy are conserved after the collision (three words)
14. a machine that can operate forever without restarting or refueling (three words)
15. the energy an object has because of its motion (two words)
18. a collision in which the first object, after an impact with the second object, travels at an angle to the direction it was originally travelling (two words)
19. the potential energy due to the stretching or compressing of an elastic material (three words)
20. an ideal collision in which external forces are minimized to the point where momentum and kinetic energy are perfectly conserved (three words)
21. energy is neither created nor destroyed, it can only change form (five words)
23. the total work done on an object equals the change in its kinetic energy (two words)
25. an ideal collision in which two objects stick together perfectly so they have the same final velocity; in this situation, momentum is perfectly conserved, but kinetic energy is not conserved (three words)
28. a system that cannot interact or exchange energy with external systems; also called a closed system (two words)
29. the amount of force exerted by a spring is directly proportional to the displacement of the spring (two words)
5. the total kinetic energy of two objects before a collision is equal to the total kinetic energy of the two objects after the collision (four words)
6. the sum of an object's kinetic and potential energies (two words)
7. the impact of one body on another
9. the maximum displacement of a wave
13. periodic motion affected by friction (three words)
16. a collision in which momentum is conserved, but kinetic energy is not conserved (two words)
17. periodic motion in which the acceleration of the moving object is proportional to its displacement (three words)
22. the product of force and time that acts on an object to produce a change in momentum
24. a system that can interact with another external system (two words)
26. the product of the magnitude of an object's displacement and the component of the applied force in the direction of displacement
27. the rate of work done by a force over time, or the rate at which the energy of an open system changes

Down

2. stored energy an object has because of its position and the applied gravitational force (three words)
3. the SI unit of work and energy



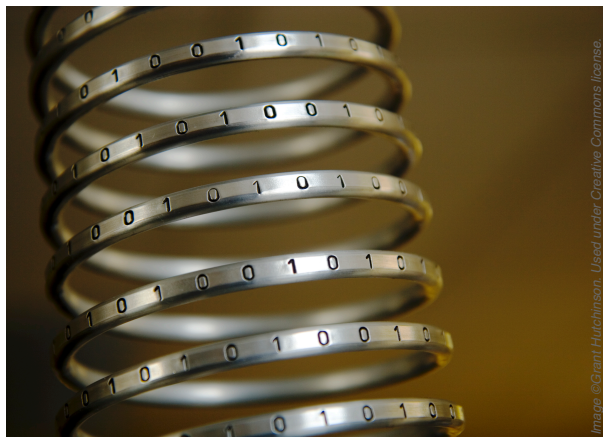


Image © Grant Hutchinson. Used under Creative Commons license.

Chapter 4

Work and Energy

- ▶ the product of the magnitude of an object's displacement and the component of the applied force in the direction of displacement
- ▶ the SI unit of work and energy
- ▶ the energy an object has because of its motion (two words)
- ▶ the total work done on an object equals the change in its kinetic energy (two words)
- ▶ the stored energy an object has that can be converted into another form of energy (two words)
- ▶ the sum of an object's kinetic and potential energies (two words)
- ▶ stored energy an object has because of its position and the applied gravitational force (three words)
- ▶ energy is neither created nor destroyed, it can only change form (five words)
- ▶ a system that cannot interact or exchange energy with external systems; also called a closed system (two words)
- ▶ a system that can interact with another external system (two words)
- ▶ a type of chemical potential energy stored in the cells and other basic structures of biological organisms (two words)
- ▶ the rate of work done by a force over time, or the rate at which the energy of an open system changes
- ▶ the amount of force exerted by a spring is directly proportional to the displacement of the spring (two words)
- ▶ the constant of variation between the force exerted by an ideal spring and the spring's displacement (two words)
- ▶ any spring that obey's Hooke's law; it does not experience any internal or external friction (two words)
- ▶ the potential energy due to the stretching or compressing of an elastic material (three words)
- ▶ the maximum displacement of a wave
- ▶ periodic motion in which the acceleration of the moving object is proportional to its displacement (three words)
- ▶ a machine that can operate forever without restarting or refueling (three words)
- ▶ periodic motion affected by friction (three words)

G	O	P	E	N	S	Y	S	T	E	M	D	R	Y	Q	F	S	U	R	C	Q	B	N	D
R	R	R	F	H	V	R	Q	F	J	N	U	H	G	L	Q	D	B	B	R	B	L	M	X
A	H	A	V	H	Z	Q	O	S	I	X	T	H	R	A	O	J	N	K	H	Z	P	B	R
V	G	U	W	R	R	F	F	I	M	O	K	N	E	W	C	Z	Z	N	W	E	F	C	W
I	Z	A	Y	P	L	J	J	M	E	T	Y	N	N	O	W	Z	B	Y	B	C	T	M	S
T	Z	N	X	H	I	Q	E	P	R	Y	M	P	E	F	O	M	D	D	T	O	J	I	D
A	B	R	B	U	X	S	R	L	O	C	E	D	L	C	O	J	U	B	K	O	D	I	H
T	P	H	V	G	Y	S	M	E	E	N	T	H	A	O	D	G	U	F	Y	X	O	L	M
I	E	F	N	D	H	K	E	H	H	T	S	V	C	N	Y	G	Y	B	G	G	D	B	D
O	R	U	V	H	E	V	C	A	T	T	Y	F	I	S	K	G	K	P	R	B	D	J	A
N	P	T	E	C	W	S	H	R	Y	G	S	P	M	E	F	Q	Y	Q	E	A	H	A	M
A	E	N	C	M	Q	Y	A	M	G	U	D	A	E	R	M	C	S	Q	N	A	T	J	P
L	T	A	J	H	V	B	N	O	R	T	E	O	H	V	R	H	S	D	E	B	H	N	E
P	U	T	T	G	J	I	I	N	E	P	T	M	C	A	P	F	D	B	L	G	H	W	D
O	A	S	I	N	E	R	C	I	N	A	A	P	O	T	O	Y	A	L	A	Z	B	J	H
T	L	N	F	I	C	Z	A	C	E	T	L	H	I	I	T	M	G	Q	I	C	Y	H	A
E	M	O	K	R	J	Z	L	M	K	W	O	B	B	O	E	N	J	J	T	A	D	M	R
N	O	C	F	P	G	N	E	O	R	F	S	W	Q	N	N	N	I	S	N	W	M	X	M
T	T	G	W	S	U	K	N	T	O	N	I	O	X	O	T	V	M	T	E	O	F	H	O
I	I	N	D	L	D	F	E	I	W	O	H	R	Y	F	I	F	Y	B	T	J	B	O	N
A	O	I	W	A	B	Z	R	O	H	R	E	K	E	E	A	G	M	T	O	U	E	O	I
L	N	R	F	E	D	B	G	N	D	M	G	F	D	N	L	X	V	Y	P	F	N	K	C
E	M	P	G	D	K	W	Y	U	I	S	G	J	U	E	E	W	O	V	C	L	E	E	M
N	A	S	B	I	M	M	H	Z	Y	S	Y	O	T	R	N	F	E	Q	I	J	J	S	O
E	C	T	C	S	W	G	P	D	S	J	H	U	I	G	E	X	B	N	T	Y	R	L	T
R	H	D	V	G	D	O	Y	H	B	T	I	L	L	Y	R	Q	P	T	S	Q	H	A	I
G	I	N	V	P	W	L	I	R	O	W	F	E	P	K	G	O	G	P	A	C	H	W	O
Y	N	T	S	E	C	T	E	A	Q	A	M	D	M	W	Y	B	J	B	L	W	T	G	N
G	E	R	R	A	D	L	B	N	F	R	Y	P	A	Q	O	H	H	M	E	T	K	I	G
D	O	Y	G	R	E	N	E	C	I	T	E	N	I	K	F	H	W	Y	Y	N	J	P	B

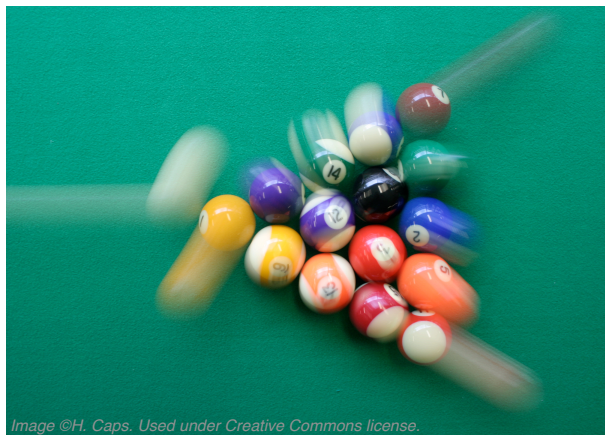


Image ©H. Caps. Used under Creative Commons license.

Chapter 5

Momentum and Collisions

Across

3. a quantity that describes the motion of an object travelling in a straight line as the product of its mass and velocity (two words)
6. the product of force and time that acts on an object to produce a change in momentum
7. a collision in which momentum and kinetic energy are conserved (two words)
8. an impact in which two objects approach each other from opposite directions; momentum and kinetic energy are conserved after the collision (three words)
9. a collision in which the first object, after an impact with the second object, travels at an angle to the direction it was originally travelling (two words)
10. the impact of one body on another

Down

1. an ideal collision in which two objects stick together perfectly so they have the same final velocity; in this situation, momentum is perfectly conserved, but kinetic energy is not conserved (three words)
2. the total kinetic energy of two objects before a collision is equal to the total kinetic energy of the two objects after the collision (four words)
4. an ideal collision in which external forces are minimized to the point where momentum and kinetic energy are perfectly conserved (three words)
5. a collision in which momentum is conserved, but kinetic energy is not conserved (two words)

Y	I	Q	V	W	M	L	E	J	V	X	G	M	L	H	Y	B	C	Q	L	K	N	Q	P
G	Q	N	M	U	T	N	E	M	O	M	R	A	E	N	I	L	T	T	P	P	W	P	V
R	Y	W	N	C	N	O	I	S	I	L	L	O	C	C	I	T	S	A	L	E	W	E	Y
E	A	W	X	R	W	C	F	W	G	T	H	V	R	Y	K	F	N	O	E	R	T	R	Q
N	B	O	T	C	A	H	B	U	N	P	E	I	F	P	I	A	J	D	H	F	M	F	X
E	G	Y	H	Y	O	G	M	I	V	B	S	Z	O	Y	T	R	O	P	E	E	B	E	R
C	S	I	M	I	X	L	A	Q	R	Q	K	L	Y	J	O	W	A	B	A	C	D	C	B
I	M	R	K	S	H	Y	L	A	T	L	C	E	L	D	I	A	U	F	D	T	D	T	P
T	M	E	G	I	N	Y	G	I	V	C	I	J	X	V	U	I	V	T	O	L	M	L	L
E	Y	C	T	C	N	R	M	M	S	I	Q	I	P	I	Z	G	Z	S	N	Y	F	Y	J
N	E	I	X	L	Z	E	V	E	J	I	P	F	Z	C	Y	V	I	M	E	E	Y	I	G
I	S	E	P	T	W	K	L	U	C	P	O	F	E	I	S	M	V	H	L	L	K	N	G
K	U	V	P	J	N	B	H	A	B	D	L	N	P	M	P	A	W	P	A	A	V	E	H
F	T	E	C	N	U	L	Z	M	S	N	J	O	K	U	N	N	R	K	S	S	R	L	B
O	R	D	O	Q	O	T	S	N	Z	T	M	K	L	A	Q	E	H	Z	T	T	J	A	S
N	Y	A	B	J	R	I	R	W	G	N	I	S	G	V	J	S	U	J	I	I	B	S	H
O	E	M	M	H	E	H	S	G	E	P	E	C	N	B	Q	E	V	X	C	C	N	T	O
I	G	A	W	S	L	I	S	I	U	Z	G	E	C	X	Y	H	B	X	C	C	G	I	Z
T	Z	S	U	B	M	O	U	C	L	S	L	Q	Q	O	L	O	E	V	O	O	L	C	Z
A	W	X	O	I	X	Z	Z	E	N	L	Z	L	G	N	L	P	P	B	L	L	Q	C	A
V	O	X	H	V	M	I	Z	D	G	Z	O	U	F	G	I	L	E	W	L	L	I	O	D
R	G	H	L	Q	F	M	H	S	E	Y	M	C	D	E	V	R	I	U	I	I	P	L	E
E	C	X	R	H	Q	C	Q	Q	T	B	E	S	G	N	O	A	B	S	S	S	F	L	G
S	I	E	D	N	W	J	C	S	F	I	S	N	Y	N	L	O	D	H	I	I	K	I	A
N	N	G	M	Q	R	P	N	D	U	J	I	P	N	P	I	Z	S	M	O	O	C	S	E
O	S	Y	R	Y	Y	V	A	M	R	Q	Y	Y	G	D	I	C	Z	D	N	N	N	I	M
C	K	M	Q	O	D	N	L	R	Q	Y	C	Y	N	X	W	L	N	I	A	X	B	O	S
M	Q	L	Z	Q	B	O	X	F	Q	W	E	Z	N	R	G	T	B	A	I	S	F	N	P
C	H	Z	C	U	H	H	H	I	Q	R	H	U	R	Q	Y	L	R	H	L	O	R	M	M
Q	S	P	P	L	C	N	O	M	Y	L	G	F	Z	A	S	I	Z	Y	B	G	V	Y	J

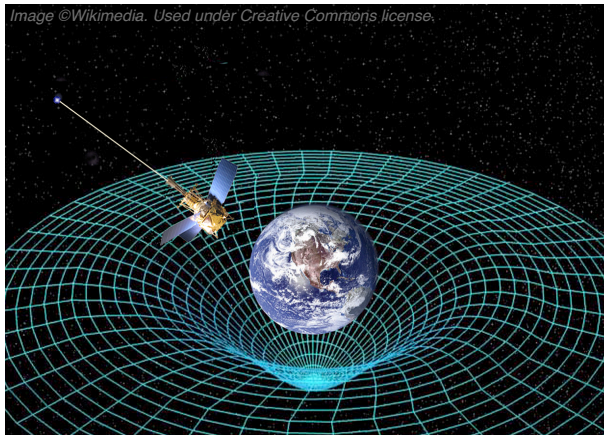


Image ©Andrzej Barabasz. Used under Creative Commons license.

Unit 2 Energy and Momentum

- ▶ the product of the magnitude of an object's displacement and the component of the applied force in the direction of displacement
- ▶ the SI unit of work and energy
- ▶ the energy an object has because of its motion (two words)
- ▶ the total work done on an object equals the change in its kinetic energy (two words)
- ▶ the stored energy an object has that can be converted into another form of energy (two words)
- ▶ the sum of an object's kinetic and potential energies (two words)
- ▶ stored energy an object has because of its position and the applied gravitational force (three words)
- ▶ energy is neither created nor destroyed, it can only change form (five words)
- ▶ a system that cannot interact or exchange energy with external systems; also called a closed system (two words)
- ▶ a system that can interact with another external system (two words)
- ▶ a type of chemical potential energy stored in the cells and other basic structures of biological organisms (two words)
- ▶ the rate of work done by a force over time, or the rate at which the energy of an open system changes
- ▶ the amount of force exerted by a spring is directly proportional to the displacement of the spring (two words)
- ▶ the constant of variation between the force exerted by an ideal spring and the spring's displacement (two words)
- ▶ any spring that obeys Hooke's law; it does not experience any internal or external friction (two words)
- ▶ the potential energy due to the stretching or compressing of an elastic material (three words)
- ▶ the maximum displacement of a wave
- ▶ periodic motion in which the acceleration of the moving object is proportional to its displacement (three words)
- ▶ a machine that can operate forever without restarting or refueling (three words)
- ▶ periodic motion affected by friction (three words)
- ▶ a quantity that describes the motion of an object travelling in a straight line as the product of its mass and velocity (two words)
- ▶ the product of force and time that acts on an object to produce a change in momentum
- ▶ the impact of one body on another
- ▶ a collision in which momentum and kinetic energy are conserved (two words)
- ▶ the total kinetic energy of two objects before a collision is equal to the total kinetic energy of the two objects after the collision (four words)
- ▶ a collision in which momentum is conserved, but kinetic energy is not conserved (two words)
- ▶ an ideal collision in which external forces are minimized to the point where momentum and kinetic energy are perfectly conserved (three words)
- ▶ an ideal collision in which two objects stick together perfectly so they have the same final velocity; in this situation, momentum is perfectly conserved, but kinetic energy is not conserved (three words)
- ▶ an impact in which two objects approach each other from opposite directions; momentum and kinetic energy are conserved after the collision (three words)
- ▶ a collision in which the first object, after an impact with the second object, travels at an angle to the direction it was originally travelling (two words)

U	Z	E	S	O	V	L	F	F	C	H	G	J	B	V	C	M	I	Z	K	I	O	U	T	F	C	R	W	M	Q
P	V	S	L	Q	P	A	U	R	T	I	C	K	R	O	W	M	U	T	N	E	M	O	M	R	A	E	N	I	L
J	J	V	G	L	M	M	V	C	M	N	A	O	X	V	X	M	D	H	A	W	C	E	H	I	A	W	N	S	G
Y	Y	F	S	I	M	P	L	E	H	A	R	M	O	N	I	C	M	O	T	I	O	N	B	X	Z	Y	Y	B	R
Q	G	B	Y	D	S	R	E	K	M	Z	D	N	D	M	P	E	O	U	L	E	P	R	I	M	N	G	I	O	U
Y	Y	R	N	M	E	C	H	A	N	I	C	A	L	E	N	E	R	G	Y	Y	A	S	O	Y	R	R	O	J	W
V	Z	O	E	F	O	A	K	Y	Z	W	Z	Q	L	C	M	T	P	G	H	Q	T	X	Y	E	C	E	M	H	Z
U	X	J	I	N	R	D	J	M	E	T	S	Y	S	N	E	P	O	D	U	G	J	F	N	P	N	N	E	P	J
W	W	H	Y	S	E	R	E	V	M	P	P	G	V	X	H	M	K	J	X	E	W	E	I	O	A	E	R	E	R
G	S	Q	N	G	C	F	H	A	W	R	Z	N	D	J	V	H	K	A	E	C	C	I	I	U	R	L	O	R	N
G	E	D	I	B	R	M	O	T	T	U	A	L	E	R	V	K	Q	L	F	I	I	T	A	J	G	A	E	P	O
D	I	M	V	B	Z	E	R	N	C	G	V	Y	Z	S	G	L	A	X	T	A	O	E	S	G	C	I	H	E	I
G	M	P	L	F	H	K	N	Q	O	Z	E	H	P	A	R	S	J	E	X	M	F	O	C	Y	P	T	T	T	S
J	P	A	E	E	X	F	M	E	Z	I	M	U	V	M	T	E	N	T	C	V	X	Z	L	G	U	N	Y	U	I
Q	L	H	R	A	V	I	E	F	L	P	T	Z	V	I	V	I	D	I	U	S	E	P	U	M	Z	E	G	A	L
O	W	E	U	T	D	I	A	S	A	A	M	A	C	D	K	C	N	U	V	Q	H	Z	O	U	K	T	R	L	L
I	Y	A	S	Y	N	R	N	X	L	Z	C	C	V	F	D	O	O	W	T	D	D	G	G	G	H	O	E	M	O
L	G	D	R	K	K	A	U	P	C	U	O	I	O	R	M	X	Y	O	W	I	U	C	N	H	K	P	N	O	C
L	R	O	K	M	S	N	T	E	C	L	P	N	M	R	E	O	F	J	Q	N	L	I	O	A	K	L	E	T	C
J	E	N	R	Y	Z	E	V	S	L	D	O	M	A	E	W	S	Z	C	Z	M	R	P	I	H	P	A	K	I	I
A	N	E	O	Q	M	Y	M	I	N	I	X	H	I	I	H	M	N	T	L	P	W	C	M	L	Y	N	R	O	T
S	E	L	V	B	J	L	S	U	T	O	D	O	W	D	L	C	J	O	S	W	O	T	S	A	Y	O	O	N	S
Q	C	A	J	C	O	I	Y	A	O	E	C	C	T	E	G	L	O	L	C	J	B	L	Q	J	H	I	W	M	A
V	I	S	N	P	O	Z	V	L	P	O	O	G	S	C	O	G	A	I	Z	F	S	G	Y	O	O	T	J	A	L
W	T	T	K	N	O	R	E	M	R	L	W	O	N	O	U	E	R	Q	B	O	O	W	Q	U	Y	A	Z	C	E
T	E	I	Y	M	E	W	A	Q	L	C	V	X	O	I	D	N	L	X	H	Y	Q	W	Q	L	W	T	K	H	N
B	N	C	Z	S	M	D	E	I	H	F	P	O	Q	I	R	W	W	N	W	N	Q	R	A	E	P	I	N	I	I
A	I	C	N	S	O	M	S	R	R	H	L	F	F	E	V	P	L	D	I	C	W	V	E	L	I	V	E	N	Y
F	K	O	E	E	K	I	J	A	Z	X	L	X	L	J	B	E	S	I	I	I	I	J	U	I	I	A	G	E	L
R	C	L	T	Q	O	Y	E	L	A	S	T	I	C	P	O	T	E	N	T	I	A	L	E	N	E	R	G	Y	T
P	Y	L	D	N	L	S	N	B	G	L	O	D	P	S	X	A	Z	T	V	B	Y	F	R	D	W	G	K	T	C
K	L	I	P	E	R	F	E	C	T	L	Y	E	L	A	S	T	I	C	C	O	L	L	I	S	I	O	N	M	E
A	J	S	G	I	S	O	L	A	T	E	D	S	Y	S	T	E	M	X	F	X	A	O	V	S	C	A	I	O	F
B	A	I	Y	Q	E	Q	E	F	Z	Y	I	N	E	L	A	S	T	I	C	C	O	L	L	I	S	I	O	N	R
V	H	O	O	K	E	S	L	A	W	K	I	N	O	I	S	I	L	L	O	C	G	N	I	C	N	A	L	G	E
Y	N	N	Y	K	G	O	W	M	M	B	C	R	R	F	J	H	G	B	W	W	O	X	B	X	T	Q	K	R	P
S	Q	N	X	J	N	D	A	A	Z	W	M	C	F	P	B	B	B	L	F	V	G	Y	V	W	K	Z	Z	V	R
K	S	L	H	E	H	U	B	Y	Q	O	E	P	P	O	T	E	N	T	I	A	L	E	N	E	R	G	Y	O	E



Chapter 6

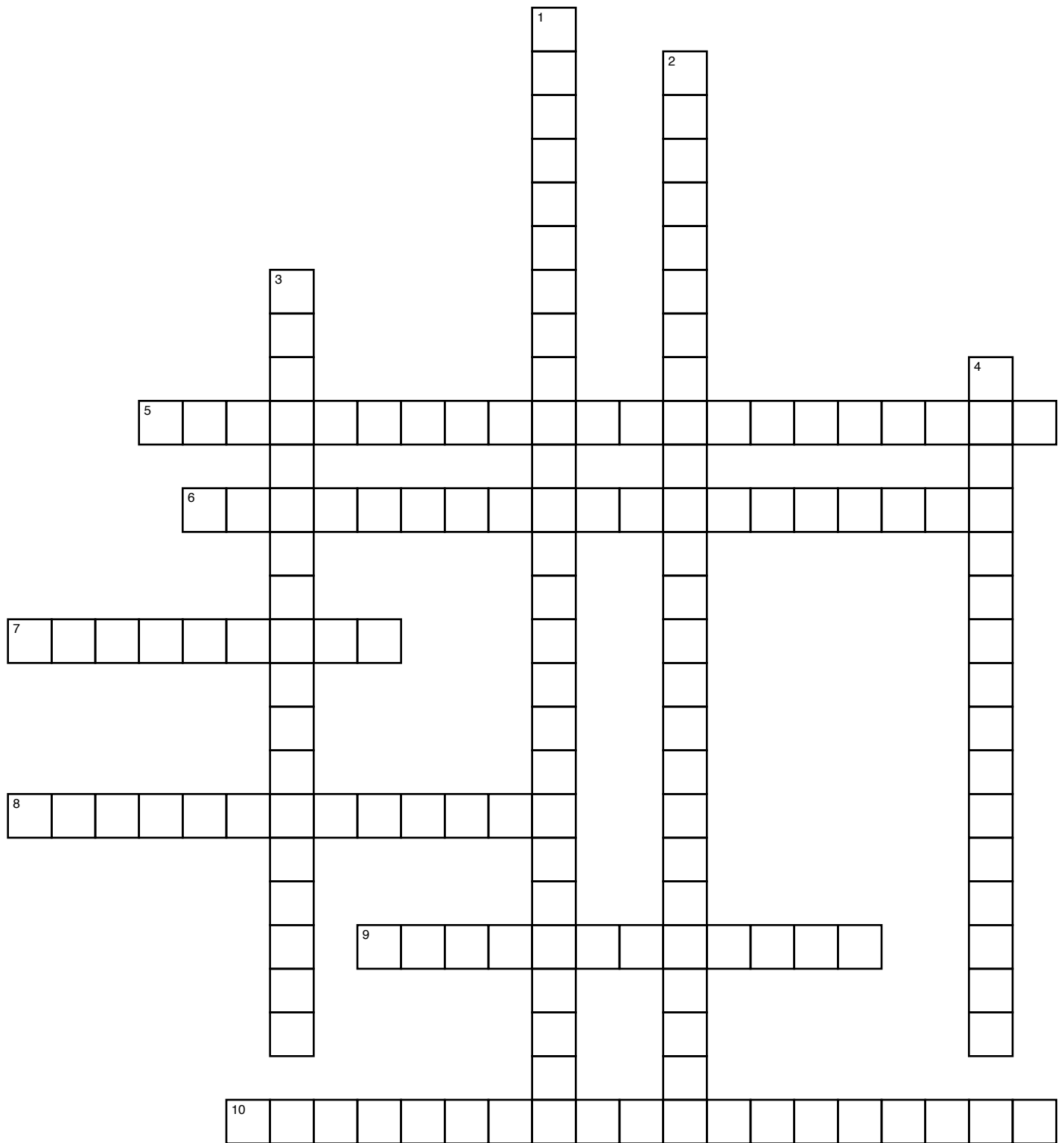
Gravitational Fields

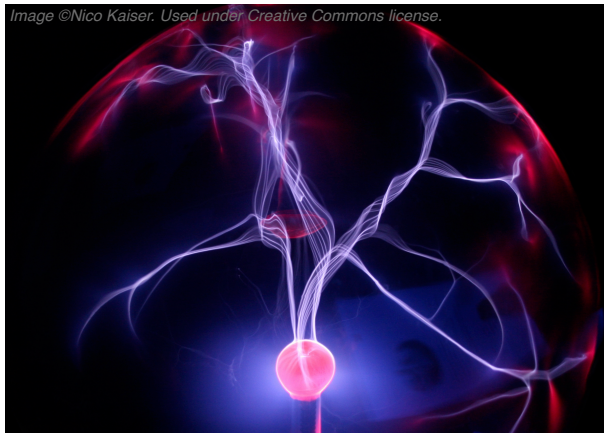
Across

5. a constant that appears in the universal law of gravitation; the constant is written as “G” (two words)
6. an object that has been intentionally placed by humans into orbit around Earth or another body; referred to as “artificial” to distinguish from natural satellites such as the Moon (two words)
7. an object or body that revolves around another body due to gravitational attraction
8. the distance between the centre of a satellite and the centre of its parent body (two words)
9. a spacecraft in which people live and work (two words)
10. the orbit around Earth of an object with an orbital speed matching the Earth’s rate of rotation; the period of such an orbit is exactly one Earth day (two words)

Down

1. the magnitude of the gravitational field vector at a point in space (three words)
2. there is a gravitational attraction between any two objects; the magnitude of the force is proportional to the product of their masses, and inversely proportional to the square of the distance separating them (four words)
3. a collection of vectors, one at each point in space, that determines the magnitude and direction of the gravitational force (two words)
4. a mathematical relationship in which one variable is proportional to the inverse of the square of another variable; the law applies to gravitational forces and other phenomena, such as electric field strength and sound intensity (two words)





Chapter 7

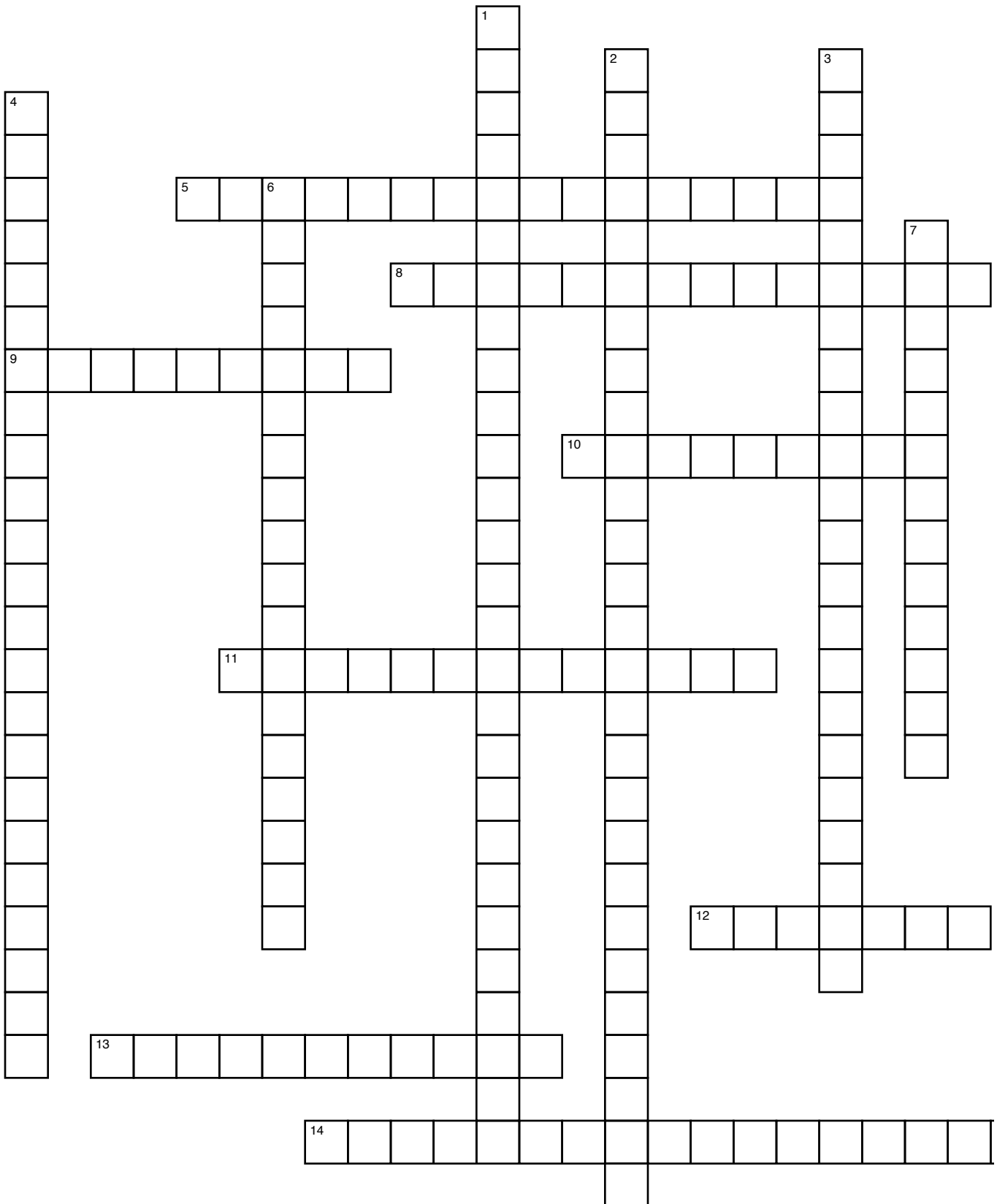
Electric Fields

Across

5. the magnitude of the electric charge carried by a proton, equal to the absolute value of the electric charge of an electron (two words)
8. a pair of equal and opposite electric charges with centres separated by a small distance (two words)
9. any substance in which electrons are not able to move easily from one atom to another
10. any substance in which electrons are able to move easily from one atom to another
11. the region in which a force is exerted on an electric charge; the electric force per unit positive charge (two words)
12. the SI unit of electric charge
13. the force between two point charges is inversely proportional to the square of the distance between the charges and directly proportional to the product of the charges (two words)
14. the value, in volts, of potential energy per unit positive charge for a given point in an electric field (two words)

Down

1. a measurable natural value that never varies and can be determined by experimentation (three words)
2. the amount of work required per unit charge to move a positive charge from one point to another in the presence of an electric field (three words)
3. the resultant, or net, vector acting at a given point equals the sum of the individual vectors from all sources, each calculated at the given point (two words)
4. the energy stored in a system of two charges a distance apart, or the energy stored in an electric field that can do work on a positively charged particle (three words)
6. the continuous lines of force around charges that show the direction of the electric force at all points in the electric field (three words)
7. a force with magnitude and direction that acts between two charged particles (two words)





Chapter 8

Magnetic Fields

Across

4. a process in which magnetic fields interact with atoms in the human body, producing images that doctors can use to diagnose injuries and diseases (three words)
6. a scientific model that describes forces in terms of entities that exist at every point in space (two words)

Down

1. a technology that uses microchips that act as transmitters and responders to communicate data by radio waves (two words)
2. a fluid containing suspended iron particles that, when subjected to a magnetic field, changes into a solid (two words)
3. one of a set of lines drawn to indicate the strength and direction of a magnetic field (three words)
5. the SI unit for describing the strength of a magnetic field





Unit 3

Gravitational, Electric, and Magnetic Fields

Across

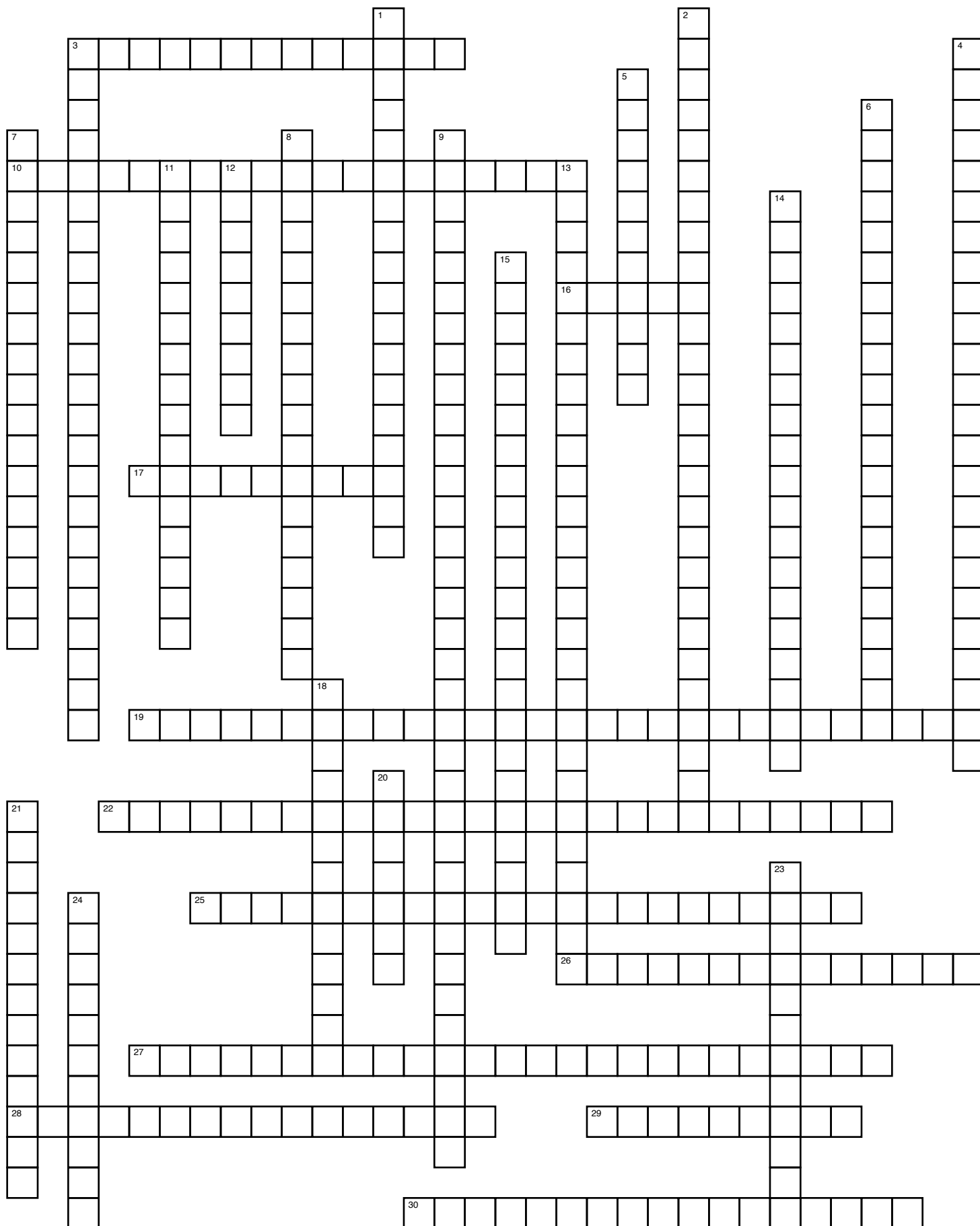
3. a force with magnitude and direction that acts between two charged particles (two words)
10. an object that has been intentionally placed by humans into orbit around Earth or another body; referred to as "artificial" to distinguish from natural satellites such as the Moon (two words)
16. the SI unit for describing the strength of a magnetic field
17. an object or body that revolves around another body due to gravitational attraction
19. a technology that uses microchips that act as transmitters and responders to communicate data by radio waves (two words)
22. the magnitude of the gravitational field vector at a point in space (three words)
25. the resultant, or net, vector acting at a given point equals the sum of the individual vectors from all sources, each calculated at the given point (two words)
26. a pair of equal and opposite electric charges with centres separated by a small distance (two words)
27. there is a gravitational attraction between any two objects; the magnitude of the force is proportional to the product of their masses, and inversely proportional to the square of the distance separating them (four words)
28. the magnitude of the electric charge carried by a proton, equal to the absolute value of the electric charge of an electron (two words)

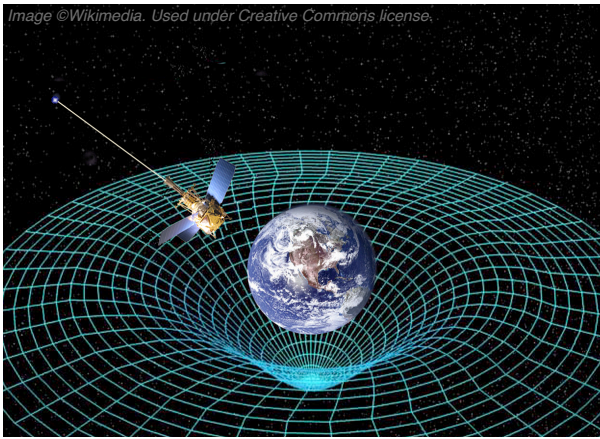
29. any substance in which electrons are able to move easily from one atom to another
30. the value, in volts, of potential energy per unit positive charge for a given point in an electric field (two words)

Down

1. a collection of vectors, one at each point in space, that determines the magnitude and direction of the gravitational force (two words)
2. a measurable natural value that never varies and can be determined by experimentation (three words)
3. the energy stored in a system of two charges a distance apart, or the energy stored in an electric field that can do work on a positively charged particle (three words)
4. a process in which magnetic fields interact with atoms in the human body, producing images that doctors can use to diagnose injuries and diseases (three words)
5. the force between two point charges is inversely proportional to the square of the distance between the charges and directly proportional to the product of the charges (two words)
6. a constant that appears in the universal law of gravitation; the constant is written as "G" (two words)
7. one of a set of lines drawn to indicate the strength and direction of a magnetic field (three words)
8. the continuous lines of force around charges that show the direction of the electric force at all points in the electric field (three words)

9. the electric potential is inversely proportional to the distance from the charge and proportional to the amount of charge producing the field (seven words)
11. a mathematical relationship in which one variable is proportional to the inverse of the square of another variable; the law applies to gravitational forces and other phenomena, such as electric field strength and sound intensity (two words)
12. any substance in which electrons are not able to move easily from one atom to another
13. the amount of work required per unit charge to move a positive charge from one point to another in the presence of an electric field (three words)
14. the orbit around Earth of an object with an orbital speed matching the Earth's rate of rotation; the period of such an orbit is exactly one Earth day (two words)
15. a fluid containing suspended iron particles that, when subjected to a magnetic field, changes into a solid (two words)
18. the distance between the centre of a satellite and the centre of its parent body (two words)
20. the SI unit of electric charge
21. the region in which a force is exerted on an electric charge; the electric force per unit positive charge (two words)
23. a spacecraft in which people live and work (two words)
24. a scientific model that describes forces in terms of entities that exist at every point in space (two words)



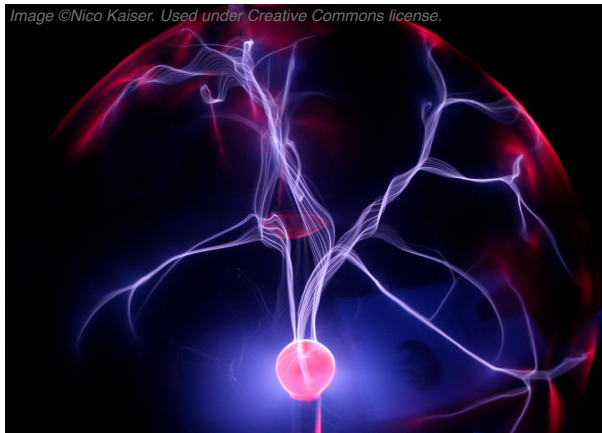


Chapter 6

Gravitational Fields

- ▶ a constant that appears in the universal law of gravitation; the constant is written as “G” (two words)
- ▶ there is a gravitational attraction between any two objects; the magnitude of the force is proportional to the product of their masses, and inversely proportional to the square of the distance separating them (four words)
- ▶ a mathematical relationship in which one variable is proportional to the inverse of the square of another variable; the law applies to gravitational forces and other phenomena, such as electric field strength and sound intensity (two words)
- ▶ a collection of vectors, one at each point in space, that determines the magnitude and direction of the gravitational force (two words)
- ▶ the magnitude of the gravitational field vector at a point in space (three words)
- ▶ an object or body that revolves around another body due to gravitational attraction
- ▶ an object that has been intentionally placed by humans into orbit around Earth or another body; referred to as “artificial” to distinguish from natural satellites such as the Moon (two words)
- ▶ the distance between the centre of a satellite and the centre of its parent body (two words)
- ▶ a spacecraft in which people live and work (two words)
- ▶ the orbit around Earth of an object with an orbital speed matching the Earth’s rate of rotation; the period of such an orbit is exactly one Earth day (two words)

Y	C	H	F	M	L	X	M	I	Q	E	D	G	J	G	K	G	E	E	J	M	D	M	E
D	X	Q	J	M	R	C	T	Z	Z	N	T	A	W	G	M	E	H	E	J	H	H	T	X
I	H	D	P	J	T	V	W	G	G	L	N	X	W	Y	K	O	H	Y	R	S	G	H	I
S	T	U	A	S	K	C	M	W	U	O	R	V	P	B	Q	S	Y	F	J	H	H	M	T
Z	G	N	Q	S	H	Y	H	U	N	O	B	E	V	V	V	Y	E	S	Z	R	S	E	R
A	N	E	A	M	H	I	S	Y	I	V	X	E	I	N	E	N	Y	V	M	U	X	T	F
W	E	M	A	T	P	T	X	Y	V	L	R	V	N	V	V	C	F	O	U	I	F	I	Y
H	R	A	U	Y	S	K	I	H	E	H	C	O	X	K	O	H	L	A	K	F	C	L	J
A	T	F	J	O	R	N	G	M	R	H	I	I	N	V	S	R	W	C	C	N	W	L	L
A	S	K	D	F	Q	O	O	R	S	T	S	P	U	B	C	O	U	T	W	Y	F	E	N
R	D	A	O	P	L	D	S	C	A	I	C	K	Z	V	I	N	D	U	D	Q	R	T	C
U	L	P	C	X	E	I	V	T	L	Z	C	I	S	F	Y	O	L	B	V	J	I	A	A
W	E	M	C	C	K	U	S	Z	L	A	G	O	D	K	X	U	E	W	J	N	L	S	I
A	I	P	G	M	T	E	L	U	A	B	N	T	F	C	C	S	I	B	L	C	N	L	K
L	F	B	Y	Q	C	H	M	G	W	H	L	O	R	Q	D	O	F	P	O	Z	N	A	C
E	L	Y	S	A	A	H	T	F	O	K	P	F	I	O	V	R	L	L	I	Q	J	I	O
R	A	V	P	J	H	U	O	V	F	M	H	I	A	T	X	B	A	I	K	P	T	C	Y
A	N	S	T	A	P	V	R	N	G	J	Y	S	S	K	A	I	N	Y	W	U	V	I	N
U	O	S	J	Y	G	V	B	K	R	U	G	X	Q	K	F	T	O	S	T	W	D	F	M
Q	I	D	K	C	W	G	I	E	A	G	K	F	W	K	M	S	I	W	K	R	G	I	Y
S	T	S	A	C	J	X	T	X	V	Y	A	V	Y	V	Z	G	T	V	W	S	G	T	X
E	A	A	V	M	X	T	A	W	I	E	Q	C	Y	R	O	K	A	F	A	F	Q	R	V
S	T	T	T	T	Q	X	L	Q	T	V	L	O	R	M	K	N	T	A	H	R	O	A	S
R	I	E	H	D	L	V	R	X	A	S	M	Y	K	P	Z	J	I	R	B	R	G	T	U
E	V	L	E	N	C	H	A	D	T	O	Q	O	W	R	A	F	V	L	B	U	X	X	X
V	A	L	O	V	C	R	D	K	I	O	H	O	A	R	K	F	A	S	E	Y	R	V	D
N	R	I	A	X	N	F	I	G	O	L	X	E	O	P	P	N	R	E	B	G	K	A	Z
I	G	T	R	T	X	F	U	E	N	P	B	G	L	K	N	B	G	M	U	A	K	R	X
R	Q	E	Y	H	N	M	S	J	O	Q	D	Q	D	R	K	M	R	L	R	U	X	P	R
T	D	V	O	L	F	H	N	Y	T	F	O	Q	I	H	R	X	K	Z	O	C	B	V	W



Chapter 7

Electric Fields

- ▶ the SI unit of electric charge
- ▶ any substance in which electrons are able to move easily from one atom to another
- ▶ any substance in which electrons are not able to move easily from one atom to another
- ▶ a force with magnitude and direction that acts between two charged particles (two words)
- ▶ the force between two point charges is inversely proportional to the square of the distance between the charges and directly proportional to the product of the charges (two words)
- ▶ the resultant, or net, vector acting at a given point equals the sum of the individual vectors from all sources, each calculated at the given point (two words)
- ▶ the region in which a force is exerted on an electric charge; the electric force per unit positive charge (two words)
- ▶ the continuous lines of force around charges that show the direction of the electric force at all points in the electric field (three words)
- ▶ a pair of equal and opposite electric charges with centres separated by a small distance (two words)
- ▶ the energy stored in a system of two charges a distance apart, or the energy stored in an electric field that can do work on a positively charged particle (three words)
- ▶ the value, in volts, of potential energy per unit positive charge for a given point in an electric field (two words)
- ▶ the amount of work required per unit charge to move a positive charge from one point to another in the presence of an electric field (three words)
- ▶ the electric potential is inversely proportional to the distance from the charge and proportional to the amount of charge producing the field (seven words)
- ▶ a measurable natural value that never varies and can be determined by experimentation (three words)
- ▶ the magnitude of the electric charge carried by a proton, equal to the absolute value of the electric charge of an electron (two words)

E	L	P	I	C	N	I	R	P	N	O	I	T	I	S	O	P	R	E	P	U	S	L	F
L	L	Z	N	A	V	A	N	T	S	Z	Z	Z	T	R	J	V	I	U	J	V	R	V	U
E	M	E	I	Z	B	M	N	K	C	T	Z	Z	M	F	Q	C	M	O	C	R	P	J	N
C	D	C	C	D	Q	S	J	O	P	N	W	N	E	I	K	O	E	C	U	I	I	J	D
T	K	W	K	T	E	R	J	Q	C	O	U	L	O	M	B	S	L	A	W	F	T	A	A
R	E	M	N	V	R	I	Z	X	H	C	K	P	O	V	K	X	C	E	F	G	M	B	M
I	T	E	E	G	V	I	L	H	N	J	X	H	E	U	S	P	Q	N	Y	S	V	J	E
C	P	H	G	L	W	W	C	P	E	C	R	O	F	C	I	R	T	C	E	L	E	I	N
P	X	Z	R	P	O	K	E	P	H	S	K	T	G	Z	S	P	W	N	Q	Y	Z	I	T
O	M	S	A	H	C	P	F	K	O	P	I	N	S	U	L	A	T	O	R	B	A	Z	A
T	M	M	H	M	F	M	I	O	K	T	E	Z	O	H	B	H	X	H	J	Q	P	J	L
E	W	H	C	C	X	T	K	D	M	F	E	N	I	T	Y	C	F	H	W	H	J	L	P
N	W	C	Y	F	A	V	A	P	C	E	E	N	K	A	I	D	Q	I	T	P	C	U	H
T	A	T	R	A	R	S	K	Z	I	I	U	C	T	L	B	W	T	F	M	R	Q	L	Y
I	B	M	A	Z	S	E	C	L	R	I	R	R	A	I	U	D	A	X	T	U	S	E	S
A	T	B	T	A	C	U	N	I	X	X	I	T	L	E	A	I	G	U	U	A	I	Y	I
L	W	F	N	W	D	T	S	P	H	D	I	V	C	B	T	L	Q	B	F	W	Q	K	C
D	R	U	E	D	L	E	I	F	C	I	R	T	C	E	L	E	E	C	W	H	V	K	A
I	U	O	M	E	E	K	D	C	C	X	O	H	U	O	L	C	N	N	J	H	Q	W	L
F	V	I	E	O	Y	R	A	W	P	D	G	R	J	A	O	E	S	S	E	K	Y	R	C
F	I	U	L	S	Y	C	Z	B	S	F	E	N	N	H	K	N	Q	K	Z	R	B	C	O
E	F	V	E	K	U	O	P	P	O	Q	C	D	H	M	O	T	R	R	Z	X	G	K	N
R	K	I	F	Z	J	W	R	Z	H	Z	N	A	U	L	G	T	K	O	M	J	P	Y	S
E	J	A	P	I	A	U	N	I	K	U	C	W	P	W	N	C	Q	N	A	G	W	E	T
N	S	R	A	X	O	Y	G	P	A	E	O	Y	X	A	C	O	C	K	O	S	S	Z	A
C	I	D	K	V	T	J	S	O	F	A	C	T	O	R	O	T	C	U	D	N	O	C	N
E	E	G	B	L	B	A	M	Y	X	M	D	M	F	W	Y	C	L	S	K	W	E	Q	T
K	S	F	Q	V	D	S	P	N	A	D	I	X	J	U	A	X	Q	J	J	E	F	U	H
V	B	C	H	Y	S	D	F	T	Q	B	N	A	C	I	R	A	Y	C	Q	E	O	P	Z
S	E	N	I	L	D	L	E	I	F	C	I	R	T	C	E	L	E	H	G	L	V	Y	N



Chapter 8

Magnetic Fields

- ▶ one of a set of lines drawn to indicate the strength and direction of a magnetic field (three words)
- ▶ the SI unit for describing the strength of a magnetic field
- ▶ a scientific model that describes forces in terms of entities that exist at every point in space (two words)
- ▶ a technology that uses microchips that act as transmitters and responders to communicate data by radio waves (two words)
- ▶ a fluid containing suspended iron particles that, when subjected to a magnetic field, changes into a solid (two words)
- ▶ a process in which magnetic fields interact with atoms in the human body, producing images that doctors can use to diagnose injuries and diseases (three words)

H	D	H	N	Q	M	T	K	W	J	M	M	M	V	Z	Q	R	R	M	H	I	Y	G	O
L	U	C	O	N	R	P	O	L	W	Q	B	T	B	B	T	U	I	Y	S	Z	L	W	N
M	W	F	I	U	Z	M	B	Z	E	R	W	C	C	S	P	O	H	L	A	N	U	I	M
I	R	X	T	P	V	U	E	V	G	S	G	N	W	S	P	P	Q	Z	U	C	T	F	O
S	Y	E	A	Y	M	Z	K	U	H	R	W	T	T	O	R	L	T	O	E	E	L	K	T
Q	S	L	C	C	A	H	C	T	R	O	L	T	M	V	J	N	R	K	P	A	I	E	H
U	F	U	I	T	G	R	I	S	O	C	E	Q	R	O	O	X	F	T	J	P	S	M	U
R	Q	W	F	R	N	J	U	E	P	I	Y	G	N	H	O	J	X	L	O	L	B	A	N
E	W	C	I	O	E	M	R	L	H	G	E	A	O	Y	I	A	A	G	A	Y	S	G	T
C	E	K	T	S	T	I	G	M	X	P	U	V	S	Z	X	C	B	L	S	Z	S	N	W
E	U	C	N	Y	O	K	N	D	N	O	F	M	Z	K	H	D	Z	K	Y	L	I	E	N
Q	F	T	E	G	R	M	N	K	Y	I	N	B	V	J	Z	U	E	R	H	H	U	T	L
L	P	J	D	Z	H	A	N	C	W	Q	H	V	J	F	S	P	O	F	U	Z	F	I	P
L	X	B	I	Z	E	G	S	T	D	J	U	W	M	M	A	E	U	O	E	K	P	C	D
P	M	K	Y	G	O	N	L	O	J	F	I	J	Z	Z	H	F	U	U	W	J	X	R	G
L	E	A	C	P	L	E	K	H	G	W	L	S	E	T	M	X	D	F	K	M	D	E	B
Z	X	E	N	C	O	T	C	K	C	Z	H	R	D	O	Q	Z	X	I	W	V	W	S	R
R	Y	W	E	Z	G	I	R	A	P	U	D	L	P	H	E	T	Y	L	J	I	O	O	E
G	T	J	U	K	I	C	F	K	I	O	E	F	C	Z	V	F	A	H	F	L	Y	N	A
P	J	E	Q	X	C	F	A	O	B	I	X	P	D	J	L	X	Q	A	V	C	A	A	M
E	X	M	E	L	A	I	R	A	F	G	M	G	G	T	X	R	V	G	C	O	D	N	R
H	K	D	R	Z	L	E	H	K	V	M	F	L	R	Q	V	L	P	L	M	A	L	C	B
F	D	U	F	G	F	L	N	A	X	W	V	N	O	N	R	V	Y	Q	Z	L	I	E	O
L	V	C	O	W	L	D	B	Z	Y	Q	O	F	P	T	G	P	A	J	P	I	U	I	T
F	L	V	I	D	U	L	L	Q	W	K	A	L	X	F	J	P	W	M	N	W	K	M	Q
A	X	Z	D	S	I	I	S	N	F	M	J	P	G	P	E	X	R	H	Y	F	I	A	W
O	M	C	A	J	D	N	M	F	J	G	S	G	Z	U	X	C	M	U	O	J	Y	G	E
O	D	D	R	X	T	E	X	E	F	T	O	K	E	S	X	K	A	V	L	G	W	I	Z
P	G	Q	P	U	B	K	J	Q	A	H	Y	G	U	R	D	N	C	Z	J	L	V	N	Y
A	G	M	T	Q	Q	Y	Z	M	C	U	E	C	J	W	J	U	R	N	O	X	X	G	N

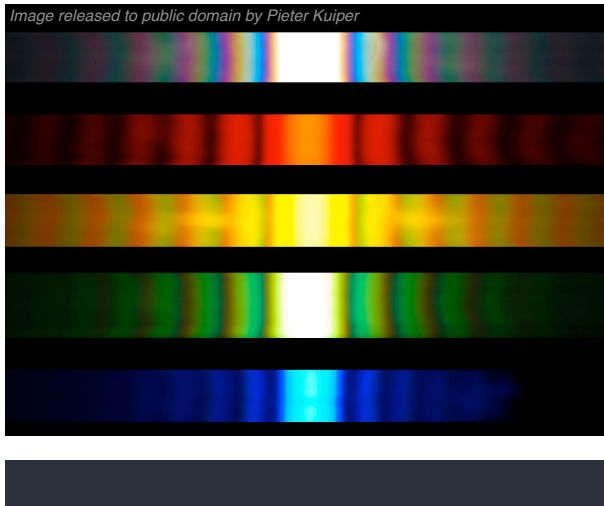


Unit 3

Gravitational, Electric, and Magnetic Fields

- ▶ a constant that appears in the universal law of gravitation; the constant is written as “G” (two words)
- ▶ there is a gravitational attraction between any two objects; the magnitude of the force is proportional to the product of their masses, and inversely proportional to the square of the distance separating them (four words)
- ▶ a mathematical relationship in which one variable is proportional to the inverse of the square of another variable; the law applies to gravitational forces and other phenomena, such as electric field strength and sound intensity (two words)
- ▶ a collection of vectors, one at each point in space, that determines the magnitude and direction of the gravitational force (two words)
- ▶ the magnitude of the gravitational field vector at a point in space (three words)
- ▶ an object or body that revolves around another body due to gravitational attraction
- ▶ an object that has been intentionally placed by humans into orbit around Earth or another body; referred to as “artificial” to distinguish from natural satellites such as the Moon (two words)
- ▶ the distance between the centre of a satellite and the centre of its parent body (two words)
- ▶ a spacecraft in which people live and work (two words)
- ▶ the orbit around Earth of an object with an orbital speed matching the Earth’s rate of rotation; the period of such an orbit is exactly one Earth day (two words)
- ▶ the SI unit of electric charge
- ▶ any substance in which electrons are able to move easily from one atom to another
- ▶ any substance in which electrons are not able to move easily from one atom to another
- ▶ a force with magnitude and direction that acts between two charged particles (two words)
- ▶ the force between two point charges is inversely proportional to the square of the distance between the charges and directly proportional to the product of the charges (two words)
- ▶ the resultant, or net, vector acting at a given point equals the sum of the individual vectors from all sources, each calculated at the given point (two words)
- ▶ the region in which a force is exerted on an electric charge; the electric force per unit positive charge (two words)
- ▶ the continuous lines of force around charges that show the direction of the electric force at all points in the electric field (three words)
- ▶ a pair of equal and opposite electric charges with centres separated by a small distance (two words)
- ▶ the energy stored in a system of two charges a distance apart, or the energy stored in an electric field that can do work on a positively charged particle (three words)
- ▶ the value, in volts, of potential energy per unit positive charge for a given point in an electric field (two words)
- ▶ the amount of work required per unit charge to move a positive charge from one point to another in the presence of an electric field (three words)
- ▶ the electric potential is inversely proportional to the distance from the charge and proportional to the amount of charge producing the field (seven words)
- ▶ a measurable natural value that never varies and can be determined by experimentation (three words)
- ▶ the magnitude of the electric charge carried by a proton, equal to the absolute value of the electric charge of an electron (two words)
- ▶ one of a set of lines drawn to indicate the strength and direction of a magnetic field (three words)
- ▶ the SI unit for describing the strength of a magnetic field
- ▶ a scientific model that describes forces in terms of entities that exist at every point in space (two words)
- ▶ a technology that uses microchips that act as transmitters and responders to communicate data by radio waves (two words)
- ▶ a fluid containing suspended iron particles that, when subjected to a magnetic field, changes into a solid (two words)
- ▶ a process in which magnetic fields interact with atoms in the human body, producing images that doctors can use to diagnose injuries and diseases (three words)

H	I	V	O	H	L	Q	Z	V	H	F	E	O	X	K	U	J	B	K	M	I	E	F	L	E	S	Q	X	V	Y	I	J
P	C	X	Z	A	H	L	E	M	J	R	E	R	K	R	W	P	C	D	F	L	O	X	L	K	T	K	D	Y	C	T	I
K	O	B	X	A	P	G	G	A	U	C	L	C	E	C	R	O	F	C	I	R	T	C	E	L	E	B	A	R	O	E	Q
U	U	T	J	E	D	I	R	G	D	O	E	J	O	Q	Y	S	Y	G	K	F	R	X	A	R	E	V	Y	E	N	L	P
U	L	Y	U	H	V	V	A	N	E	W	C	F	N	R	Z	V	C	C	F	A	V	W	E	R	L	K	Y	L	D	E	Y
M	O	R	R	J	Q	U	H	E	I	M	T	V	Q	E	U	T	G	X	S	K	X	T	O	F	E	R	M	O	U	C	M
R	M	O	D	H	P	T	C	T	K	M	R	R	W	B	Q	Z	O	F	Z	F	I	T	G	S	C	U	J	P	C	T	J
M	B	E	U	A	S	G	Y	I	K	Y	I	K	E	H	N	T	A	O	S	L	A	C	W	D	T	P	Q	I	T	R	F
E	G	H	L	E	U	Q	R	C	R	L	C	B	W	F	Q	E	L	M	L	L	Z	Y	I	Y	R	S	Q	D	O	I	T
L	N	T	T	H	I	V	A	F	Q	D	P	H	E	Y	T	G	K	E	U	A	O	U	D	Y	I	F	U	C	R	C	I
E	I	D	I	C	D	U	T	I	A	S	O	T	Q	O	J	U	T	S	L	O	L	X	I	Q	C	O	U	I	R	P	B
C	G	L	P	R	A	G	N	E	C	T	T	Q	S	U	C	A	N	S	J	F	K	Y	Q	O	P	J	Z	R	Z	O	R
T	A	E	B	H	R	M	E	L	T	L	E	E	X	F	S	I	E	U	L	V	M	U	O	R	O	M	U	T	K	T	O
R	M	I	U	K	L	Z	M	D	C	O	N	Z	O	V	Q	T	T	A	S	S	H	S	W	A	T	W	F	C	N	E	S
I	I	F	H	Z	A	I	E	L	R	N	T	A	K	H	O	C	C	F	M	Y	P	N	E	D	E	T	C	E	P	N	U
C	E	C	L	P	T	U	L	I	Y	C	I	O	O	A	Q	I	T	L	N	E	T	G	Z	Q	N	F	R	L	S	T	O
P	C	P	S	S	I	V	E	N	M	O	A	Y	G	I	G	L	I	G	D	T	G	U	M	K	T	D	J	E	U	I	N
O	N	N	O	Q	B	D	L	E	I	F	L	A	N	O	I	T	A	T	I	V	A	R	G	J	I	T	R	Z	P	A	O
T	A	F	G	F	R	G	L	K	V	G	D	C	L	V	P	Q	B	T	X	K	K	E	P	B	A	T	S	O	E	L	R
E	N	Q	H	E	O	T	O	I	Z	S	U	O	J	T	Y	A	C	I	F	P	W	Y	T	H	L	I	G	T	R	D	H
N	O	I	T	A	C	I	F	I	T	N	E	D	I	Y	C	N	E	U	Q	E	R	F	O	I	D	A	R	K	P	I	C
T	S	V	E	G	P	M	Z	W	G	H	T	V	A	L	S	P	A	C	E	S	T	A	T	I	O	N	R	G	O	F	N
I	E	W	T	N	I	B	E	W	R	X	O	J	S	O	X	Y	H	Q	K	N	B	R	I	T	X	Z	U	S	S	F	Y
A	R	V	A	Y	S	H	J	O	N	J	A	O	S	Q	G	Q	I	A	N	R	M	Y	I	T	U	X	R	K	I	E	S
L	C	Y	U	P	J	Z	T	I	H	G	P	M	I	N	V	E	R	S	E	S	Q	U	A	R	E	L	A	W	T	R	O
E	I	L	J	H	P	E	P	J	Y	S	O	J	K	Q	D	P	O	A	H	Q	D	K	N	S	H	C	G	D	I	E	E
N	T	L	S	B	N	A	P	Y	L	B	I	D	D	A	K	O	X	F	J	P	D	U	N	L	X	S	U	R	O	N	G
E	E	L	M	G	J	Z	L	G	Z	J	N	H	L	W	J	B	V	K	A	Y	Q	A	N	O	N	I	V	U	N	C	Q
R	N	A	A	O	N	Z	C	N	L	H	T	L	E	L	E	C	T	R	I	C	F	I	E	L	D	N	V	M	P	E	U
G	G	M	H	A	I	T	M	U	K	S	C	N	J	J	J	O	V	C	E	I	H	A	E	Q	K	J	Q	C	R	Q	A
Y	A	W	V	L	F	L	I	T	G	C	H	O	M	Q	Y	U	D	O	I	Z	Z	L	T	T	T	X	S	D	I	J	P
P	M	T	N	A	T	S	N	O	C	L	A	N	O	I	T	A	T	I	V	A	R	G	U	E	X	O	Q	D	N	J	J
Z	V	O	L	Q	D	K	A	Z	Z	A	R	T	I	F	I	C	I	A	L	S	A	T	E	L	L	I	T	E	C	G	U
F	L	L	J	X	M	D	L	G	R	O	G	D	R	L	W	T	Y	N	Z	N	I	C	R	P	N	X	G	O	I	Z	D
F	H	T	G	N	E	R	T	S	D	L	E	I	F	L	A	N	O	I	T	A	T	I	V	A	R	G	Y	Z	P	S	N
J	G	K	T	N	N	Y	E	L	E	C	T	R	I	C	F	I	E	L	D	L	I	N	E	S	Z	P	E	M	L	X	T
B	T	N	A	T	S	N	O	C	L	A	C	I	S	Y	H	P	L	A	T	N	E	M	A	D	N	U	F	Z	E	D	P
T	Z	S	Z	P	E	B	W	K	O	I	Q	U	P	K	Y	R	H	R	S	W	A	L	S	B	M	O	L	U	O	C	L
C	E	D	L	E	G	P	N	N	J	F	Q	A	A	G	S	T	G	L	B	U	N	A	G	Q	V	X	P	L	U	F	K
H	P	A	T	L	J	N	O	I	T	A	T	I	V	A	R	G	F	O	W	A	L	L	A	S	R	E	V	I	N	U	B



Chapter 9

Waves and Light

Across

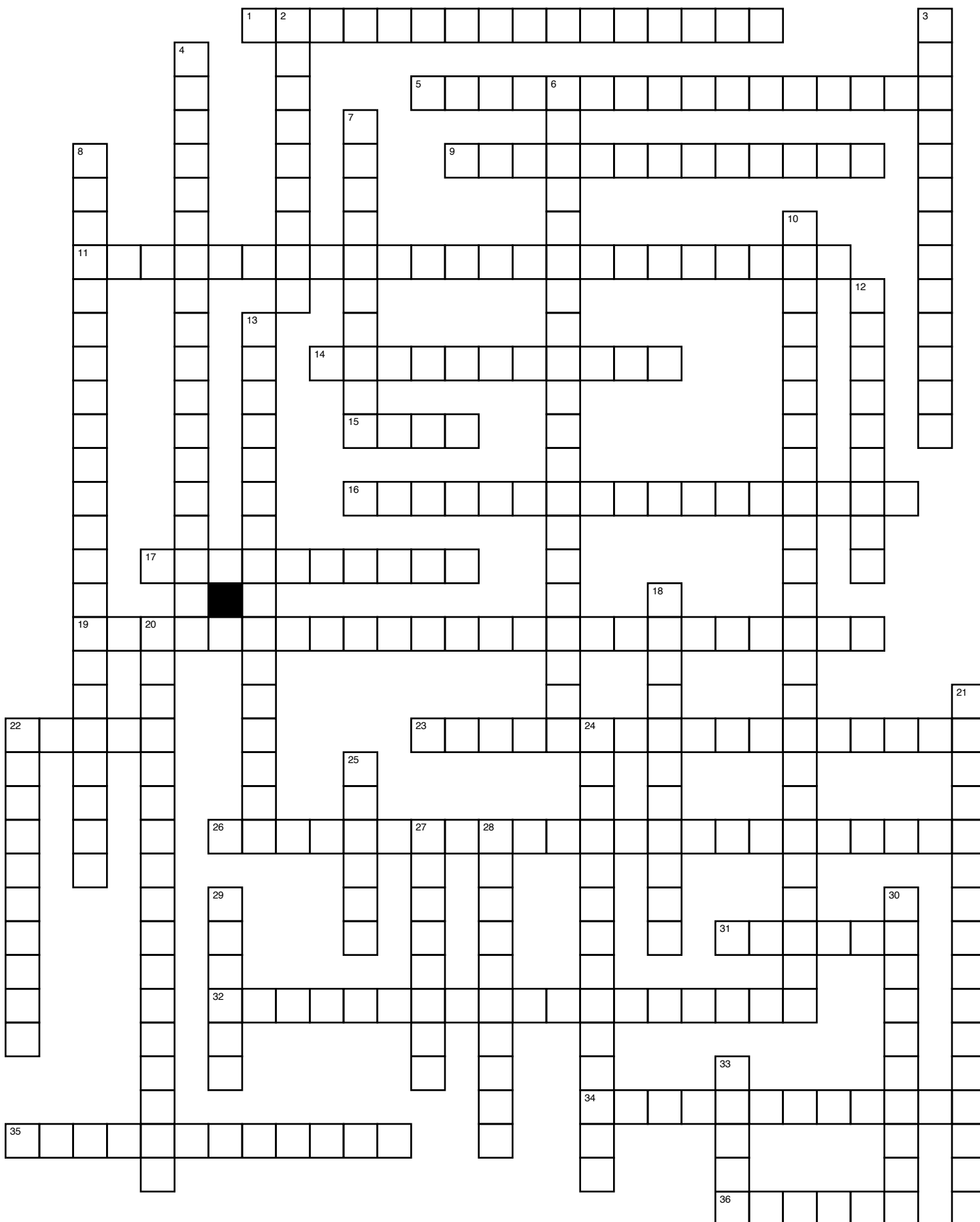
1. the angle between the incident ray and the final outgoing ray after reflection or refraction (three words)
5. treating the propagation of light waves as though they move in straight lines called rays (two words)
9. the smallest angle of incidence at which a light ray passing from one medium to another less refractive medium can be totally reflected from the boundary between them (two words)
11. an effect that occurs when light encounters a boundary between a medium of a higher index of refraction and one with a lower index of refraction (three words)
14. a technology that uses glass or plastic wire (fibre) through which data are transmitted using internally reflected light impulses (two words)
15. a point along a standing wave where the wave produces zero displacement
16. the angle that a light ray makes with respect to the normal to a surface when it has entered a different medium (three words)
17. the separation of a wave into its component parts according to a given characteristic, such as frequency or wavelength
19. a light ray will follow exactly the same path if its direction of travel is reversed (three words)
22. the offset of the wave from a reference point
23. the angle between the reflected ray and the normal (three words)

26. the phenomenon that occurs when two interfering waves have displacement in opposite directions where they superimpose (two words)
31. points of darkness, or minimum intensity, in an interference pattern
32. one of a series of alternating light and dark regions that result from the interference of waves (two words)
34. the phenomenon that occurs when two waves in the same direction interact
35. a wave with repeated pattern over time and distance (two words)
36. the lower part of a wave

Down

2. a line or curve along which destructive interference results in zero displacement (two words)
3. composed of only one colour; light with one wavelength
4. the reflection of light from a surface where all the reflected rays are in the same direction (two words)
6. the difference between path lengths, or distances (three words)
7. a change in direction of a light ray when it meets an obstacle where the incoming ray and the outgoing ray are on the same side of the obstacle
8. light travelling in straight lines (two words)
10. the phenomenon that occurs when two interfering waves have displacement in the same direction where they superimpose (two words)

12. the continuous line or surface at the start of a wave as it travels in time (two words)
13. every point on a wave front can be considered as a point source of tiny secondary wavelets that spread out in front of the wave at the same speed as the wave itself (two words)
18. the bending and spreading of a wave when it passes through an opening; dependent on the size of the opening and the wavelength of the wave
20. the ratio of the speed of light in a vacuum to the speed of light in another medium (three words)
21. the angle between the incident ray and the normal (three words)
22. the distance from point to point along a nodal line (two words)
24. the property of a material that determines how light behaves when it travels through the material (two words)
25. the line drawn at a right angle to the boundary at the point where an incident ray strikes the boundary
27. composed of waves having the same frequency and fixed phases
28. composed of waves that have no fixed phase relationship to each other and different frequencies
29. points of brightness, or maximum intensity, in an interference pattern
30. the distance between one positive amplitude and the next
33. the upper part of a wave





Chapter 10

Applications of the Wave Nature of Light

Across

1. the progressively less-intense bright areas, outside the central region, in an interference pattern (two words)
6. the change in direction of light waves as a result of collisions
8. the angle at which the direction of the reflected portion of the wave is perpendicular to the direction of the refracted portion of the wave (two words)
10. the rotation of the direction of polarization when linearly polarized light interacts with certain molecules (two words)
11. the quality of light waves that are polarized in one direction, perpendicular to the direction of propagation (two words)
13. the value of m for a given maximum in a diffraction-grating interference pattern; sequentially numbers the maxima on either side of the zero-order maximum (two words)
16. the direction of the electric field that a polarizer allows through (two words)
17. a device that allows only light with an electric field along a single direction to pass through
19. a device with a large number of equally spaced parallel slits that produces interference patterns (two words)
20. the bright central region in an interference pattern of light and dark lines produced in diffraction (two words)
21. light waves that vibrate in a single plane (two words)
22. light waves that vibrate in many different planes (two words)

Down

2. radiation that consists of interacting electric and magnetic fields that travel at the speed of light (two words)
3. the air between two sheets of flat glass angled to form a wedge (two words)
4. a second polarizer used to verify that the light from the first polarizer is polarized
5. the quality of light waves that are polarized in one direction, perpendicular to the direction of propagation (two words)
7. the range of frequencies and wavelengths of all electromagnetic waves (two words)
9. a thin, flat display that makes use of polarizers and optical activity (three words)
12. the first maximum of intensity on either side of the zero-order maximum in an interference pattern from a diffraction grating (two words)
14. the ability of an optical device to separate close objects into distinct and sharp images
15. the location of maximum intensity in the diffraction pattern at $\theta = 0^\circ$ (two words)
18. a very thin layer of a substance, usually on a supporting material (two words)





Image ©Alex Law. Used under Creative Commons license.

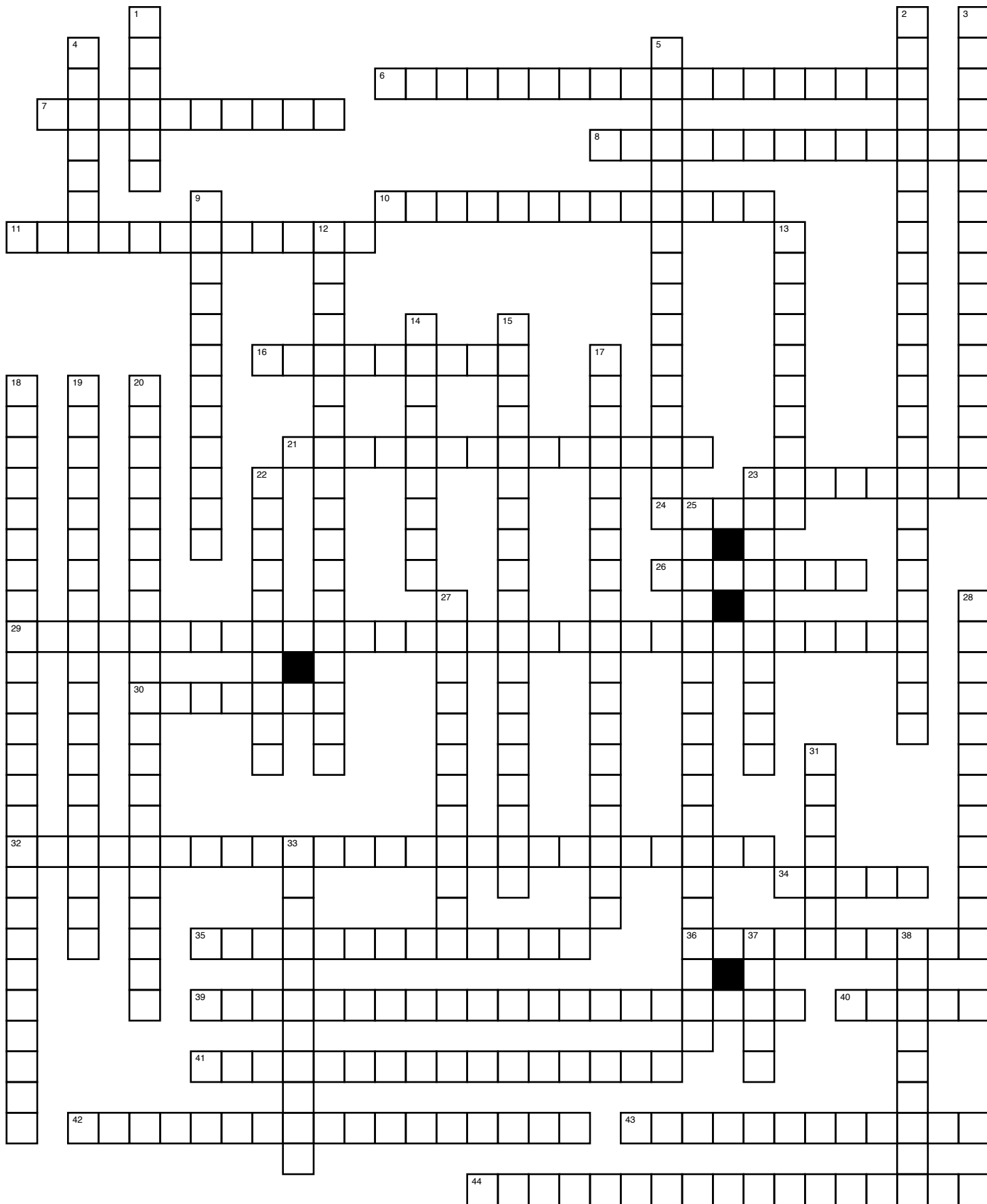
Unit 4 The Wave Nature of Light

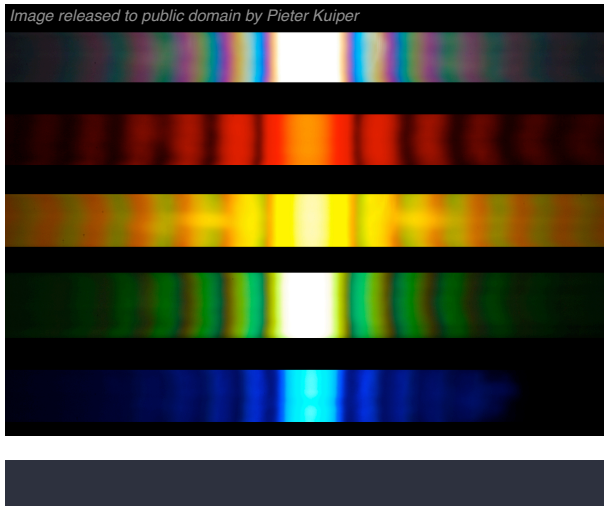
Across

6. radiation emitted by an ideal blackbody (two words)
7. the wave-like behaviour of particles with mass (two words)
8. the elastic scattering of photons by high-energy photons (two words)
10. the modern theory of fundamental particles and their interactions (two words)
11. the occurrence of two or more events at the same time
16. a statement assumed to be true from which a theory is developed
21. a constant that represents the ratio of the energy of a single quantum to its frequency (two words)
23. the mass of an object measured at rest with respect to the observer; also called the proper mass (two words)
24. the proposed medium through which electromagnetic waves were once believed to propagate
26. a class of particles that includes the electron, the muon, the tauon, and the three types of neutrino; not composed of smaller particles
29. mathematical statement that says that if Δx is the uncertainty in a particle's position, and Δp is the uncertainty in its momentum, then $\Delta x \Delta p = h \div (4\pi)$, where h is Planck's constant (three words)
30. a fundamental particle that forms matter
32. the energy of an object in excess of its rest energy (three words)
34. the particle responsible for transmitting electromagnetic, strong, and weak forces
35. the theoretical basis of modern physics that explains the nature and behaviour of matter and energy at the atomic and subatomic levels (two words)
36. the theoretical particle thought to play a role in giving mass to other particles (two words)
39. the momentum of objects moving at speeds near the speed of light (two words)
40. an elementary particle that makes up protons, neutrons, and other hadrons
41. time that is not absolute, but changes relative to the observer (two words)
42. the shortening of distances in an inertial frame of reference moving relative to an observer in another inertial frame of reference (two words)
43. the minimum energy needed to remove an electron bound to a metal surface (two words)
44. a mental exercise used to investigate the potential consequences of a hypothesis or postulate (two words)
17. the phenomenon of electrons being ejected from a material when exposed to electromagnetic radiation (two words)
18. all physical laws are the same in all inertial frames of reference, and the speed of light is independent of the motion of the light source or its observer in all inertial frames of reference (four words)
19. the property of matter that defines its dual nature of displaying both wave-like and particle-like characteristics (two words)
20. the laws of motion are the same in all inertial frames (three words)
22. the time interval measured by an observer at rest with respect to a clock (two words)
23. the amount of energy an object at rest has with respect to an observer (two words)
25. a theory that attempts to combine three fundamental forces (weak, strong, and electromagnetic) with gravity into a single theory (three words)
27. the length of an object or distance between two points s measured by an observer who is stationary relative to the object or distance (two words)
28. the slowing down of time in one reference frame moving relative to an observer in another reference frame (two words)
31. a class of particles that contains the neutron, the proton, and the pion; composed of combinations of quarks and anti-quarks
33. a thought experiment in which a traveller in one frame of reference returns from a voyage to learn that time has passed more slowly in his spacecraft relative to the passage of time on Earth, despite the seemingly symmetric predictions of special relativity (two words)
37. a particle that mediates the strong nuclear force
38. a four-dimensional coordinate system in which the three space coordinates are combined with time, a fourth dimension

Down

1. a discrete bundle of energy carried by light
2. the principle that rest mass and energy are equivalent (three words)
3. the mass of an object measured by an observer moving with speed v with respect to the object (two words)
4. the smallest amount of energy that a particle can emit or absorb; the plural is quanta
5. a coordinate system relative to which motion is described or observed (three words)
9. the transformation of a photon into two particles with mass (two words)
12. the minimum frequency at which electrons are ejected from a material (two words)
13. a form of matter in which each particle has the same mass and an opposite charge as its counterpart in ordinary matter
14. an object that absorbs all radiation reaching it
15. the wavelength associated with the motion of a particle possessing momentum of magnitude p (three words)





Chapter 9

Waves and Light

- ▶ a wave with repeated pattern over time and distance (two words)
- ▶ the continuous line or surface at the start of a wave as it travels in time (two words)
- ▶ the upper part of a wave
- ▶ the lower part of a wave
- ▶ the distance between one positive amplitude and the next
- ▶ the offset of the wave from a reference point
- ▶ treating the propagation of light waves as though they move in straight lines called rays (two words)
- ▶ a change in direction of a light ray when it meets an obstacle where the incoming ray and the outgoing ray are on the same side of the obstacle
- ▶ the line drawn at a right angle to the boundary at the point where an incident ray strikes the boundary
- ▶ the angle between the incident ray and the normal (three words)
- ▶ the angle between the reflected ray and the normal (three words)
- ▶ the reflection of light from a surface where all the reflected rays are in the same direction (two words)
- ▶ the reflection of light from a surface where all the reflected rays are directed in many different directions (two words)
- ▶ the bending of light as it travels at an angle from one medium to another
- ▶ the property of a material that determines how light behaves when it travels through the material (two words)
- ▶ a light ray will follow exactly the same path if its direction of travel is reversed (three words)
- ▶ the ratio of the speed of light in a vacuum to the speed of light in another medium (three words)
- ▶ the angle that a light ray makes with respect to the normal to a surface when it has entered a different medium (three words)
- ▶ the separation of a wave into its component parts according to a given characteristic, such as frequency or wavelength
- ▶ the angle between the incident ray and the final outgoing ray after reflection or refraction (three words)
- ▶ the smallest angle of incidence at which a light ray passing from one medium to another less refractive medium can be totally reflected from the boundary between them (two words)
- ▶ an effect that occurs when light encounters a boundary between a medium of a higher index of refraction and one with a lower index of refraction (three words)
- ▶ a technology that uses glass or plastic wire (fibre) through which data are transmitted using internally reflected light impulses (two words)
- ▶ the bending and spreading of a wave when it passes through an opening; dependent on the size of the opening and the wavelength of the wave
- ▶ the phenomenon that occurs when two waves in the same direction interact
- ▶ the phenomenon that occurs when two interfering waves have displacement in the same direction where they superimpose (two words)
- ▶ the phenomenon that occurs when two interfering waves have displacement in opposite directions where they superimpose (two words)
- ▶ composed of waves having the same frequency and fixed phases
- ▶ a point along a standing wave where the wave produces zero displacement
- ▶ a line or curve along which destructive interference results in zero displacement (two words)
- ▶ the distance from point to point along a nodal line (two words)
- ▶ the difference between path lengths, or distances (three words)
- ▶ every point on a wave front can be considered as a point source of tiny secondary wavelets that spread out in front of the wave at the same speed as the wave itself (two words)
- ▶ light travelling in straight lines (two words)
- ▶ composed of waves that have no fixed phase relationship to each other and different frequencies
- ▶ composed of only one colour; light with one wavelength
- ▶ one of a series of alternating light and dark regions that result from the interference of waves (two words)
- ▶ points of brightness, or maximum intensity, in an interference pattern
- ▶ points of darkness, or minimum intensity, in an interference pattern

W	O	K	N	O	I	T	C	A	R	F	E	R	F	O	E	L	G	N	A	W	F	J	Y	Y	B	R	J	U
A	G	F	J	O	Z	X	G	V	C	T	Q	H	P	H	Q	H	O	Y	R	Y	Q	U	C	R	E	S	T	V
V	H	E	R	P	N	J	D	E	F	P	M	F	O	N	Q	D	I	N	T	E	R	F	E	R	E	N	C	E
E	P	E	T	T	N	I	D	W	J	D	J	G	J	E	F	N	O	I	T	C	E	L	F	E	R	L	E	G
F	E	V	K	I	S	O	Q	J	A	M	T	K	A	B	O	V	L	B	D	F	B	I	B	I	A	N	I	F
R	S	D	M	C	N	C	I	Y	F	Y	P	P	O	H	T	H	T	J	C	I	Y	B	T	E	W	J	W	B
O	S	D	M	A	N	O	I	T	C	E	L	F	E	R	R	A	L	U	C	E	P	S	B	V	J	J	I	P
N	A	E	S	L	P	G	O	I	C	N	R	V	A	N	G	L	E	O	F	D	E	V	I	A	T	I	O	N
T	B	S	R	D	Q	X	O	L	K	A	O	N	O	D	A	L	L	I	N	E	H	N	S	W	X	S	U	C
C	E	T	B	E	A	K	B	I	R	I	R	M	F	Z	I	S	S	E	V	C	T	K	U	C	C	X	I	K
X	U	R	G	N	A	G	H	B	S	P	E	F	A	U	I	C	N	E	T	N	G	A	D	I	C	N	I	V
X	X	U	F	S	P	S	X	I	K	Y	F	V	F	N	W	I	T	C	W	E	N	G	L	D	B	O	W	Y
N	Z	C	Y	I	X	R	D	S	V	U	T	I	H	I	C	T	N	N	N	R	E	Z	R	O	C	I	O	Q
Q	O	T	C	T	A	S	M	R	L	B	N	H	D	G	D	P	E	E	B	E	L	V	R	I	O	T	D	O
A	R	I	K	Y	N	F	V	E	S	W	E	Y	L	N	J	O	R	R	H	F	H	L	E	R	I	C	Y	G
D	M	V	T	A	G	G	G	V	L	S	R	T	D	P	W	E	E	E	E	R	T	V	C	E	N	E	Q	M
N	L	E	A	C	L	R	D	E	H	R	E	R	W	P	O	R	H	F	L	E	A	U	T	P	D	L	Y	S
H	D	I	G	R	E	A	Y	R	F	R	H	O	Y	A	X	B	O	F	P	T	P	P	I	D	E	F	N	H
M	I	N	S	I	O	L	M	F	C	Q	O	U	B	M	E	I	C	I	I	N	E	B	L	A	X	E	O	B
R	M	T	R	T	F	T	F	O	H	C	C	G	W	I	Q	F	L	D	C	I	S	P	I	R	O	R	I	C
T	B	E	J	I	I	S	H	E	F	D	N	H	D	X	P	C	W	H	N	E	A	E	N	T	F	E	T	I
S	R	R	C	C	N	O	H	L	R	J	I	M	O	A	U	A	M	T	I	V	H	I	E	J	R	S	A	T
Q	C	F	B	A	C	L	J	P	Q	L	Z	B	J	M	V	W	I	G	R	I	P	N	A	O	E	U	M	A
E	V	E	N	L	I	F	W	I	F	N	A	C	F	E	N	P	Z	N	P	T	Y	O	R	C	F	F	I	M
S	I	R	M	A	D	J	W	C	E	G	A	N	L	M	M	I	T	E	S	C	L	I	P	J	R	F	X	O
F	T	E	Q	N	E	E	I	N	Y	A	X	E	R	Q	O	Z	X	L	N	U	Z	T	R	Q	A	I	O	R
Y	O	N	F	G	N	W	G	I	R	O	N	S	V	E	L	C	Y	H	E	R	I	C	O	P	C	D	R	H
S	U	C	P	L	C	U	I	R	R	G	N	U	C	D	T	Z	F	T	G	T	Z	A	P	E	T	C	P	C
T	Z	E	B	E	E	I	T	P	T	U	Y	D	Y	C	F	N	Y	A	Y	S	J	R	A	X	I	Y	P	O
E	T	B	Q	K	X	E	E	H	R	M	N	U	P	C	L	Q	I	P	U	N	Y	F	G	W	O	F	A	N
A	N	G	L	E	O	F	R	E	F	L	E	C	T	I	O	N	K	L	H	O	L	E	A	G	N	Q	Y	O
L	D	N	U	W	F	T	Z	C	O	Y	V	M	L	S	V	N	D	H	A	C	K	R	T	Q	H	W	A	M
Z	H	E	G	N	I	R	F	E	C	N	E	R	E	F	R	E	T	N	I	T	A	Y	I	N	O	M	R	K
S	A	L	Z	R	S	T	K	M	X	K	X	O	Q	Q	P	S	D	P	X	C	O	T	O	F	I	V	O	A
H	X	X	F	B	C	F	I	Z	T	Z	Q	S	B	A	M	I	N	I	M	L	X	T	N	G	L	S	X	J
D	I	S	P	E	R	S	I	O	N	H	Y	T	Q	P	H	V	O	P	J	N	L	A	M	R	O	N	Y	L



Chapter 10

Applications of the Wave Nature of Light

- ▶ a very thin layer of a substance, usually on a supporting material (two words)
- ▶ the air between two sheets of flat glass angled to form a wedge (two words)
- ▶ an interference pattern that shows distinctive differences between the bright central fringe and darker flanking fringes (two words)
- ▶ the bright central region in an interference pattern of light and dark lines produced in diffraction (two words)
- ▶ the progressively less-intense bright areas, outside the central region, in an interference pattern (two words)
- ▶ the ability of an optical device to separate close objects into distinct and sharp images
- ▶ a device with a large number of equally spaced parallel slits that produces interference patterns (two words)
- ▶ the location of maximum intensity in the diffraction pattern at $\theta = 0^\circ$ (two words)
- ▶ the first maximum of intensity on either side of the zero-order maximum in an interference pattern from a diffraction grating (two words)
- ▶ the value of m for a given maximum in a diffraction-grating interference pattern; sequentially numbers the maxima on either side of the zero-order maximum (two words)
- ▶ radiation that consists of interacting electric and magnetic fields that travel at the speed of light (two words)
- ▶ the range of frequencies and wavelengths of all electromagnetic waves (two words)
- ▶ light waves that vibrate in a single plane (two words)
- ▶ light waves that vibrate in many different planes (two words)
- ▶ a device that allows only light with an electric field along a single direction to pass through
- ▶ the quality of light waves that are polarized in one direction, perpendicular to the direction of propagation (two words)
- ▶ the quality of light waves that are polarized in one direction, perpendicular to the direction of propagation (two words)
- ▶ the direction of the electric field that a polarizer allows through (two words)
- ▶ a second polarizer used to verify that the light from the first polarizer is polarized
- ▶ the angle at which the direction of the reflected portion of the wave is perpendicular to the direction of the refracted portion of the wave (two words)
- ▶ the change in direction of light waves as a result of collisions
- ▶ the rotation of the direction of polarization when linearly polarized light interacts with certain molecules (two words)
- ▶ a thin, flat display that makes use of polarizers and optical activity (three words)

B	S	E	C	O	N	D	A	R	Y	M	A	X	I	M	A	P	F	X	C	F	N	M	L
M	D	J	N	I	R	T	B	J	T	T	M	I	W	Y	O	W	R	O	Y	W	G	U	O
U	Z	U	X	V	Y	E	E	E	D	Z	P	P	R	B	Y	N	B	M	R	E	L	K	A
R	B	W	Q	V	G	B	V	N	N	O	G	L	A	W	F	Z	B	H	P	V	O	D	C
T	Y	M	F	J	N	E	T	H	O	F	A	B	Y	A	E	N	N	X	G	N	B	H	R
C	A	Q	T	H	G	W	D	K	I	F	E	J	D	M	Z	D	U	C	P	Z	L	M	C
E	W	F	M	C	G	V	Z	D	T	I	G	V	A	C	J	B	G	R	F	R	J	I	D
P	P	L	A	N	E	P	O	L	A	R	I	Z	E	D	V	T	A	E	Y	E	P	F	F
S	N	H	N	N	E	C	L	N	I	S	F	V	A	R	R	A	N	O	G	J	J	R	L
C	K	H	W	O	O	O	T	O	D	T	P	W	P	S	X	E	A	T	J	C	N	A	Y
I	Y	M	I	I	K	K	H	P	A	O	P	N	S	F	P	L	L	R	V	I	Y	U	M
T	M	U	L	T	G	M	G	C	R	R	U	H	Y	G	C	G	Y	A	A	L	A	N	U
E	B	M	I	U	P	D	I	B	C	D	N	N	Q	O	Y	N	Z	N	W	P	L	H	M
N	I	I	N	L	Q	I	L	W	I	E	P	L	T	P	K	A	E	S	R	K	P	O	I
G	D	X	E	O	G	F	D	T	T	R	O	U	Z	T	K	S	R	M	T	I	S	F	X
A	W	A	A	S	T	F	E	Z	E	M	L	D	C	I	U	R	M	I	U	J	I	E	A
M	B	M	R	E	X	R	Z	N	N	A	A	R	V	C	Q	E	X	S	V	T	D	R	M
O	I	R	L	R	A	A	I	G	G	X	R	E	Y	A	V	T	Z	S	K	O	L	D	L
R	U	E	Y	P	S	C	R	N	A	I	I	B	X	L	H	S	M	I	V	T	A	I	A
T	L	D	P	Y	A	T	A	I	M	M	Z	M	V	A	M	W	O	O	I	H	T	F	R
C	K	R	O	A	O	I	L	R	O	U	E	U	P	C	Y	E	C	N	S	I	S	F	T
E	Q	O	L	Y	R	O	O	E	R	M	D	N	N	T	X	R	N	A	S	N	Y	R	N
L	H	O	A	P	X	N	P	T	T	G	L	R	D	I	J	B	X	X	F	F	R	A	E
E	B	R	R	Q	U	G	X	T	C	N	I	E	T	V	J	J	K	I	E	I	C	C	C
T	U	E	I	I	Y	R	C	A	E	R	G	D	J	I	N	X	Y	S	W	L	D	T	P
G	L	Z	Z	C	X	A	U	C	L	Y	H	R	V	T	K	R	N	E	O	M	I	I	G
L	C	Y	E	C	F	T	C	S	E	K	T	O	H	Y	P	Z	Q	R	A	B	U	O	N
Y	C	A	D	F	N	I	P	S	P	O	L	A	R	I	Z	E	R	E	X	F	Q	N	N
H	W	I	D	S	H	N	Z	I	C	T	P	P	L	Q	W	E	N	Q	E	K	I	S	L
B	V	Z	E	S	U	G	I	O	M	P	U	E	D	V	V	L	K	S	Q	V	L	A	O



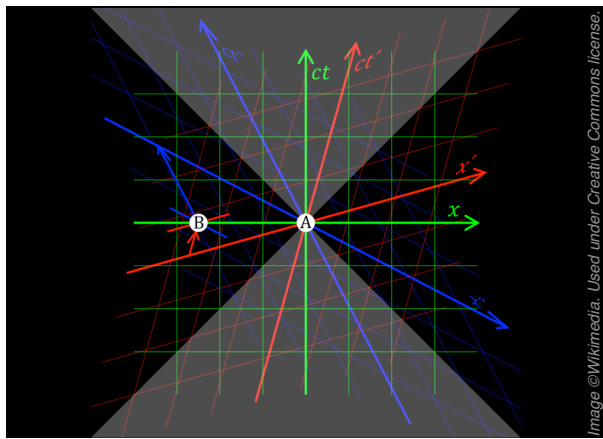
Image ©Alex Law. Used under Creative Commons license.

Unit 4

The Wave Nature of Light

- ▶ a wave with repeated pattern over time and distance (two words)
- ▶ the continuous line or surface at the start of a wave as it travels in time (two words)
- ▶ the upper part of a wave
- ▶ the lower part of a wave
- ▶ the distance between one positive amplitude and the next
- ▶ the offset of the wave from a reference point
- ▶ treating the propagation of light waves as though they move in straight lines called rays (two words)
- ▶ a change in direction of a light ray when it meets an obstacle where the incoming ray and the outgoing ray are on the same side of the obstacle
- ▶ the line drawn at a right angle to the boundary at the point where an incident ray strikes the boundary
- ▶ the angle between the incident ray and the normal (three words)
- ▶ the angle between the reflected ray and the normal (three words)
- ▶ the reflection of light from a surface where all the reflected rays are in the same direction (two words)
- ▶ the reflection of light from a surface where all the reflected rays are directed in many different directions (two words)
- ▶ the bending of light as it travels at an angle from one medium to another
- ▶ the property of a material that determines how light behaves when it travels through the material (two words)
- ▶ a light ray will follow exactly the same path if its direction of travel is reversed (three words)
- ▶ the ratio of the speed of light in a vacuum to the speed of light in another medium (three words)
- ▶ the angle that a light ray makes with respect to the normal to a surface when it has entered a different medium (three words)
- ▶ the separation of a wave into its component parts according to a given characteristic, such as frequency or wavelength
- ▶ the angle between the incident ray and the final outgoing ray after reflection or refraction (three words)
- ▶ the smallest angle of incidence at which a light ray passing from one medium to another less refractive medium can be totally reflected from the boundary between them (two words)
- ▶ an effect that occurs when light encounters a boundary between a medium of a higher index of refraction and one with a lower index of refraction (three words)
- ▶ a technology that uses glass or plastic wire (fibre) through which data are transmitted using internally reflected light impulses (two words)
- ▶ the bending and spreading of a wave when it passes through an opening; dependent on the size of the opening and the wavelength of the wave
- ▶ the phenomenon that occurs when two waves in the same direction interact
- ▶ the phenomenon that occurs when two interfering waves have displacement in the same direction where they superimpose (two words)
- ▶ the phenomenon that occurs when two interfering waves have displacement in opposite directions where they superimpose (two words)
- ▶ composed of waves having the same frequency and fixed phases
- ▶ a point along a standing wave where the wave produces zero displacement
- ▶ a line or curve along which destructive interference results in zero displacement (two words)
- ▶ the distance from point to point along a nodal line (two words)
- ▶ the difference between path lengths, or distances (three words)
- ▶ every point on a wave front can be considered as a point source of tiny secondary wavelets that spread out in front of the wave at the same speed as the wave itself (two words)
- ▶ light travelling in straight lines (two words)
- ▶ composed of waves that have no fixed phase relationship to each other and different frequencies
- ▶ composed of only one colour; light with one wavelength
- ▶ one of a series of alternating light and dark regions that result from the interference of waves (two words)
- ▶ points of brightness, or maximum intensity, in an interference pattern
- ▶ points of darkness, or minimum intensity, in an interference pattern
- ▶ a very thin layer of a substance, usually on a supporting material (two words)
- ▶ the air between two sheets of flat glass angled to form a wedge (two words)
- ▶ an interference pattern that shows distinctive differences between the bright central fringe and darker flanking fringes (two words)
- ▶ the bright central region in an interference pattern of light and dark lines produced in diffraction (two words)
- ▶ the progressively less-intense bright areas, outside the central region, in an interference pattern (two words)
- ▶ the ability of an optical device to separate close objects into distinct and sharp images
- ▶ a device with a large number of equally spaced parallel slits that produces interference patterns (two words)
- ▶ the location of maximum intensity in the diffraction pattern at $\theta = 0^\circ$ (two words)
- ▶ the first maximum of intensity on either side of the zero-order maximum in an interference pattern from a diffraction grating (two words)
- ▶ the value of m for a given maximum in a diffraction-grating interference pattern; sequentially numbers the maxima on either side of the zero-order maximum (two words)
- ▶ radiation that consists of interacting electric and magnetic fields that travel at the speed of light (two words)
- ▶ the range of frequencies and wavelengths of all electromagnetic waves (two words)
- ▶ light waves that vibrate in a single plane (two words)
- ▶ light waves that vibrate in many different planes (two words)
- ▶ a device that allows only light with an electric field along a single direction to pass through
- ▶ the quality of light waves that are polarized in one direction, perpendicular to the direction of propagation (two words)
- ▶ the quality of light waves that are polarized in one direction, perpendicular to the direction of propagation (two words)
- ▶ the direction of the electric field that a polarizer allows through (two words)
- ▶ a second polarizer used to verify that the light from the first polarizer is polarized
- ▶ the angle at which the direction of the reflected portion of the wave is perpendicular to the direction of the refracted portion of the wave (two words)
- ▶ the change in direction of light waves as a result of collisions
- ▶ the rotation of the direction of polarization when linearly polarized light interacts with certain molecules (two words)
- ▶ a thin, flat display that makes use of polarizers and optical activity (three words)

R	E	L	P	I	C	N	I	R	P	S	N	E	G	Y	U	H	G	K	F	R	E	C	N	E	R	E	F	R	E	T	N	I	S	U	C	V
A	Y	O	E	W	U	F	A	R	Z	V	C	C	F	A	V	W	U	G	V	P	H	A	S	E	Y	M	S	R	R	J	Q	U	C	X	O	M
Y	V	Q	E	U	T	M	X	S	K	X	G	U	N	P	O	L	A	R	I	Z	E	D	L	I	G	H	T	V	E	K	M	Y	R	W	N	Q
A	O	F	Z	F	I	I	O	S	A	U	J	Q	N	O	I	T	C	E	L	F	E	R	E	S	U	F	F	I	D	H	N	T	A	O	S	B
P	C	W	G	N	P	I	X	P	G	F	A	T	T	N	O	R	F	E	V	A	W	L	A	W	F	Q	E	L	M	V	F	Z	Y	V	T	S
P	Q	D	I	Z	A	N	M	G	T	H	R	E	F	L	E	C	T	I	O	N	T	N	K	E	X	J	O	R	D	Y	S	T	U	B	R	A
R	T	M	Y	I	C	C	U	K	Y	I	S	U	T	Q	O	J	U	R	U	R	G	H	X	I	Q	C	E	U	B	R	G	H	I	X	U	P
O	W	G	T	G	C	O	V	Q	S	U	C	S	Y	D	J	T	K	Y	Q	L	T	J	Z	T	Z	C	B	L	K	N	B	G	D	M	C	X
X	L	W	I	X	F	H	Y	M	U	M	V	A	U	O	R	B	M	U	E	K	C	H	N	L	T	E	K	O	N	M	F	I	E	N	T	O
I	Q	S	V	M	S	E	H	S	W	A	L	W	L	D	N	D	C	O	N	O	H	Z	V	I	A	N	R	N	C	O	K	L	S	C	I	F
M	Y	P	I	E	D	R	T	C	E	P	G	I	Y	D	C	L	F	R	U	X	Q	Y	L	T	O	I	A	Q	L	T	D	D	T	T	V	Z
A	P	A	T	H	L	E	N	G	T	H	D	I	F	F	E	R	E	N	C	E	G	I	I	L	I	L	D	T	G	U	M	E	R	D	E	P
T	N	B	C	C	N	N	Q	E	T	R	B	J	K	N	E	N	A	V	N	J	N	Y	Q	T	S	L	J	X	T	R	Z	Z	U	G	I	Y
I	G	F	A	G	L	T	V	G	Y	C	N	V	P	F	I	T	S	K	K	E	P	T	U	T	S	A	S	J	C	O	W	I	C	E	N	T
O	I	Z	L	M	R	J	N	Y	A	C	I	F	L	H	Y	H	H	I	A	G	T	O	I	V	N	D	S	X	P	B	E	R	T	X	T	I
N	A	P	A	X	B	E	O	P	J	M	T	E	T	T	G	K	T	R	T	C	Z	T	D	G	P	O	Z	W	G	P	M	A	I	L	E	L
Y	N	C	C	Q	L	R	V	A	R	R	C	G	X	N	M	U	P	T	L	Y	B	A	C	K	X	N	D	A	O	X	Y	L	V	K	R	I
R	I	T	I	H	U	S	S	Y	I	T	N	V	A	Y	S	R	O	I	N	J	W	L	R	G	G	Q	E	N	N	R	M	O	E	T	F	B
R	K	N	T	W	P	C	Y	U	I	E	Z	O	I	H	O	J	N	R	G	C	P	I	Y	N	N	N	Z	G	L	O	I	P	I	S	E	I
Y	I	A	P	H	P	R	P	O	L	S	X	A	K	P	D	E	O	E	T	Q	D	N	S	I	O	C	I	L	F	H	Z	N	N	L	R	S
H	P	P	O	L	B	D	N	E	A	K	M	X	A	J	A	D	U	L	L	X	S	T	T	T	I	N	R	E	L	M	F	J	T	L	E	R
J	S	H	L	W	J	B	V	K	A	I	Q	G	N	R	N	I	V	E	S	T	Q	E	A	A	T	S	A	O	C	N	L	H	E	L	N	E
C	E	S	W	L	H	A	X	M	X	C	A	V	L	N	R	U	I	C	B	R	A	R	L	R	C	C	L	F	M	J	J	J	R	A	C	V
I	L	A	E	Q	W	J	Q	A	Y	T	A	Y	O	W	V	E	F	T	I	A	G	N	D	G	A	A	O	D	U	O	N	Z	F	N	E	E
T	E	S	D	F	J	P	M	R	I	D	P	I	V	E	R	G	E	R	C	N	F	A	I	N	R	T	P	E	M	U	O	X	E	G	D	R
J	C	Z	V	O	L	Q	D	O	A	O	Z	N	X	G	E	D	I	O	R	S	L	L	S	O	F	T	E	V	I	G	I	D	R	L	N	F
M	T	M	D	L	G	R	N	H	L	R	C	D	T	N	B	E	N	M	I	M	P	R	P	I	E	E	N	I	X	E	T	I	E	E	O	O
U	R	R	W	O	H	V	T	A	C	Q	E	E	I	I	M	W	P	A	T	I	R	E	L	T	R	R	A	A	A	Y	C	F	N	O	R	E
M	O	F	C	R	E	K	R	N	D	I	N	X	P	R	U	R	O	G	I	S	U	F	A	C	P	I	L	T	M	G	A	F	C	F	M	L
I	M	A	X	Z	B	I	H	M	E	Z	T	O	P	F	N	I	L	N	C	S	W	L	Y	A	Q	N	P	I	R	R	R	R	E	I	A	P
X	A	P	C	Y	Z	B	M	L	V	E	R	F	E	E	R	A	A	E	A	I	A	E	G	R	T	G	L	O	E	N	F	A	Q	N	L	I
A	G	F	K	E	P	A	T	L	A	T	A	R	X	C	E	B	R	T	L	O	A	C	W	F	N	B	S	N	D	M	E	C	E	C	B	C
M	N	Q	D	S	O	M	Y	M	W	L	L	E	Z	N	D	D	I	I	A	N	U	T	V	F	K	B	T	L	R	B	R	T	R	I	L	N
R	E	T	S	Y	F	I	U	T	C	R	M	F	F	E	R	F	Z	C	N	A	U	I	I	I	H	F	N	R	O	Z	F	I	N	D	A	I
E	T	M	M	E	I	N	N	L	I	H	A	R	Q	R	O	Q	E	R	G	X	X	O	C	D	U	R	E	U	T	L	O	O	C	E	N	R
D	I	C	J	N	B	Z	R	F	D	W	X	A	P	E	R	N	R	A	L	I	Z	N	R	M	C	O	R	U	S	L	E	N	V	N	A	P
R	C	E	D	O	R	J	W	J	O	N	I	C	O	F	A	N	N	D	E	S	N	M	E	V	T	C	E	Z	R	V	L	E	Y	C	L	P
O	S	N	K	I	E	S	S	S	I	A	M	T	V	R	Z	L	Q	I	M	I	X	L	S	F	J	S	H	S	I	C	G	B	A	E	Y	X
O	P	Q	O	T	O	D	Z	E	R	S	U	I	M	E	A	Q	I	A	H	E	G	W	T	J	E	V	O	X	F	R	N	O	R	Z	Z	X
R	E	B	O	U	P	E	I	G	E	K	M	O	L	T	O	N	Y	T	K	C	K	F	S	Y	X	Z	C	Z	J	T	A	W	U	Z	E	E
E	C	T	L	L	T	M	B	Q	P	F	W	N	C	N	Y	N	O	I	T	C	A	R	F	F	I	D	R	E	F	O	H	N	U	A	R	F
Z	T	Y	B	O	I	A	N	F	H	I	R	N	Z	I	V	E	M	O	W	O	W	C	C	I	T	A	M	O	R	H	C	O	N	O	M	Z
J	R	L	H	S	C	J	O	L	R	F	X	U	A	P	L	J	P	N	Y	U	F	Q	Y	T	P	Q	M	X	C	J	I	L	Z	L	Q	Y
D	U	E	F	E	S	M	W	G	Y	U	J	U	S	Y	O	L	A	G	L	P	Y	E	L	G	N	A	S	R	E	T	S	W	E	R	B	N
H	M	M	B	R	D	R	I	S	P	E	C	U	L	A	R	R	E	F	L	E	C	T	I	O	N	Y	P	I	C	X	J	T	B	O	Z	F
R	Q	J	O	S	E	C	O	N	D	A	R	Y	M	A	X	I	M	A	D	T	W	W	T	T	X	M	H	F	C	E	U	B	Q	D	A	Q
A	L	V	Z	H	P	S	B	I	B	A	P	D	Z	X	K	E	X	H	J	E	T	U	D	I	S	P	E	R	S	I	O	N	X	S	I	M



Chapter 11

Relativity

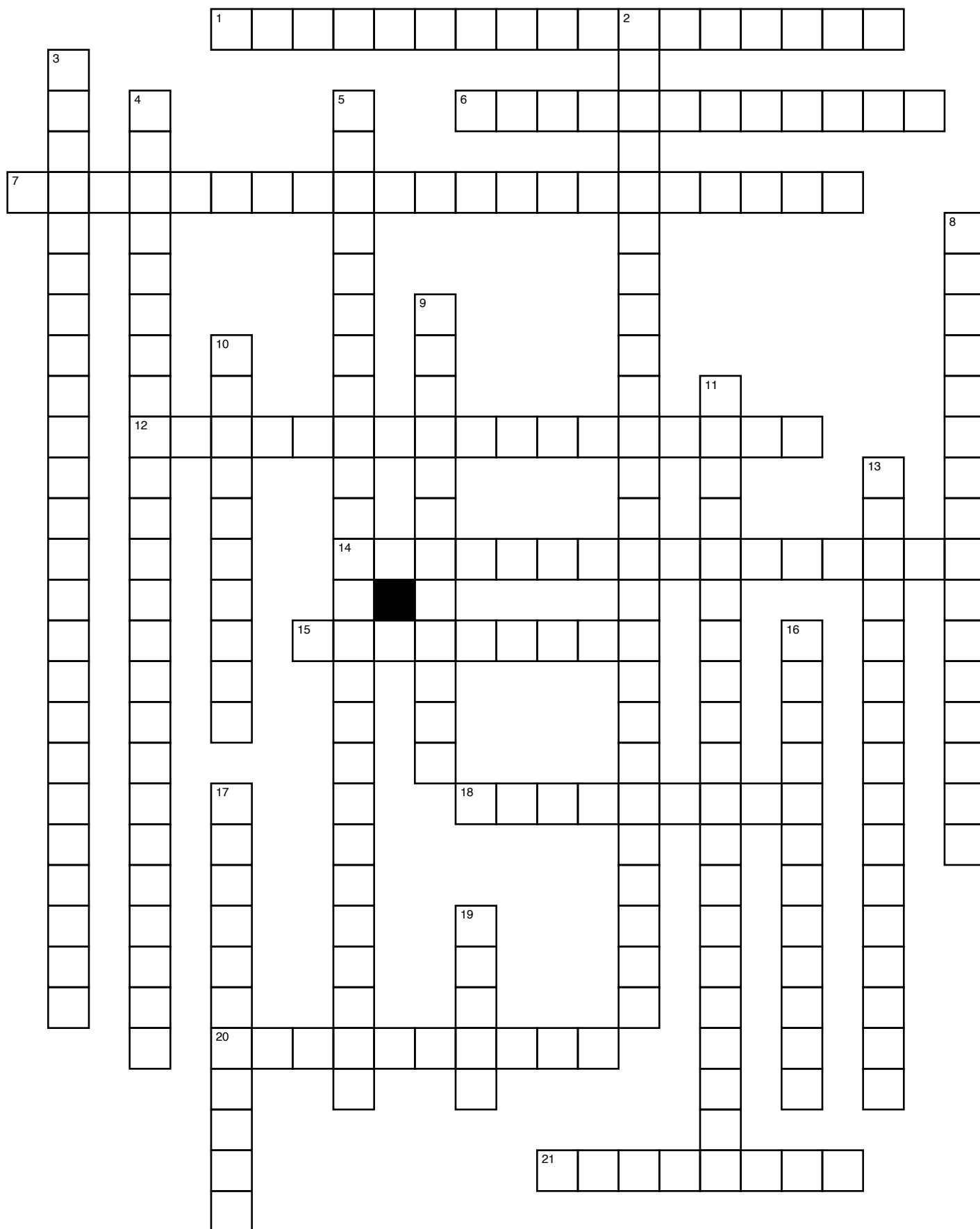
Across

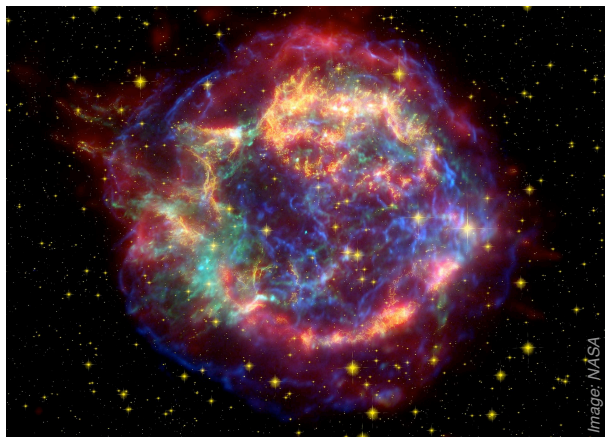
1. the shortening of distances in an inertial frame of reference moving relative to an observer in another inertial frame of reference (two words)
6. the occurrence of two or more events at the same time
7. the laws of motion are the same in all inertial frames (three words)
12. a mental exercise used to investigate the potential consequences of a hypothesis or postulate (two words)
14. the mass of an object measured by an observer moving with speed v with respect to the object (two words)
15. a statement assumed to be true from which a theory is developed
18. a four-dimensional coordinate system in which the three space coordinates are combined with time, a fourth dimension
20. the amount of energy an object at rest has with respect to an observer (two words)
21. the mass of an object measured at rest with respect to the observer; also called the proper mass (two words)

Down

2. the energy of an object in excess of its rest energy (three words)
3. a frame of reference that moves at a zero or constant velocity; the law of inertia holds (four words)
4. the principle that rest mass and energy are equivalent (three words)
5. all physical laws are the same in all inertial frames of reference, and the speed of light is independent of the motion of the light source or its observer in all inertial frames of reference (four words)
8. time that is not absolute, but changes relative to the observer (two words)
9. the slowing down of time in one reference frame moving relative to an observer in another reference frame (two words)
10. the time interval measured by an observer at rest with respect to a clock (two words)
11. the momentum of objects moving at speeds near the speed of light (two words)

13. a coordinate system relative to which motion is described or observed (three words)
16. the length of an object or distance between two points s measured by an observer who is stationary relative to the object or distance (two words)
17. a thought experiment in which a traveller in one frame of reference returns from a voyage to learn that time has passed more slowly in his spacecraft relative to the passage of time on Earth, despite the seemingly symmetric predictions of special relativity (two words)
19. the proposed medium through which electromagnetic waves were once believed to propagate





Chapter 12

Quantum Mechanics

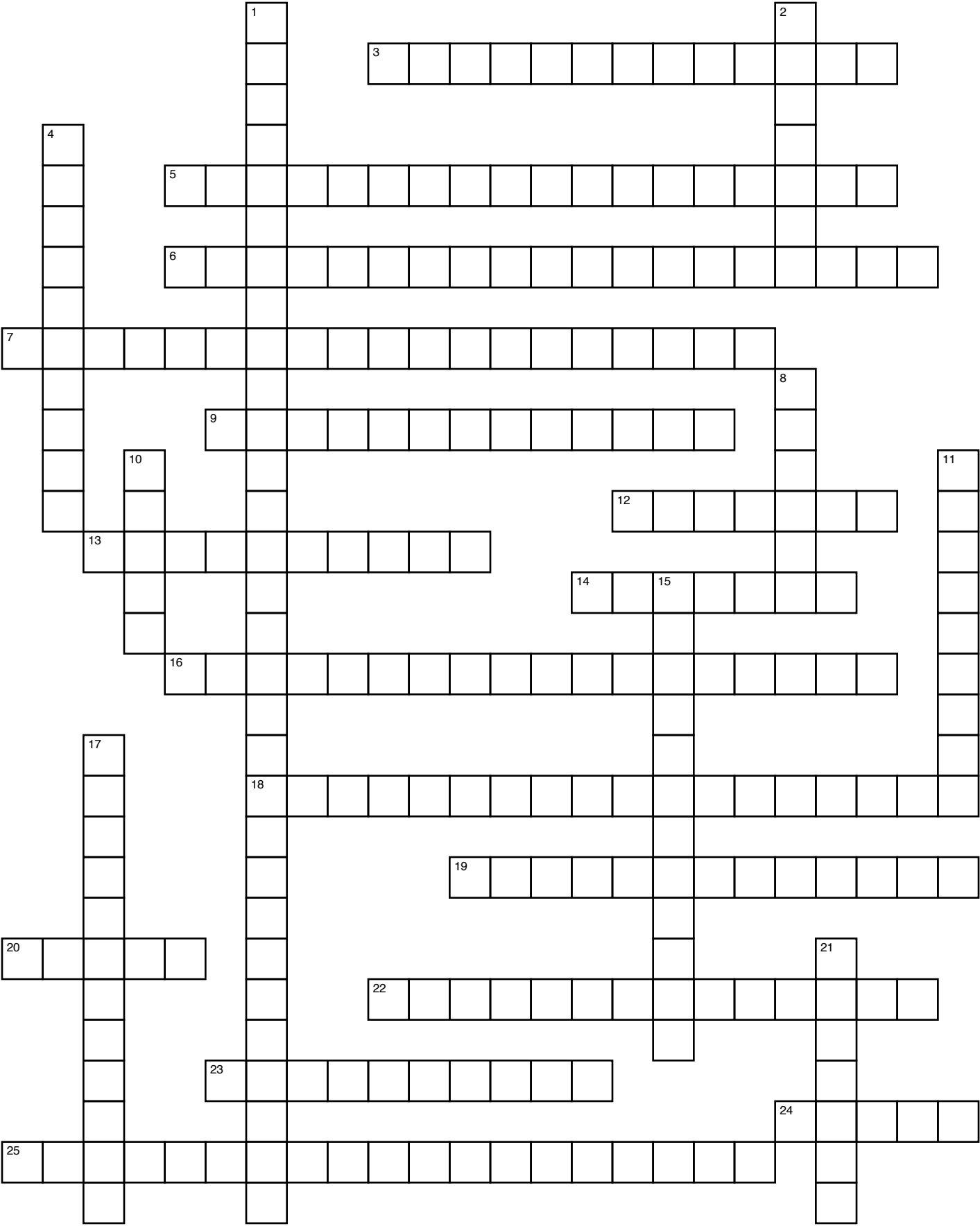
Across

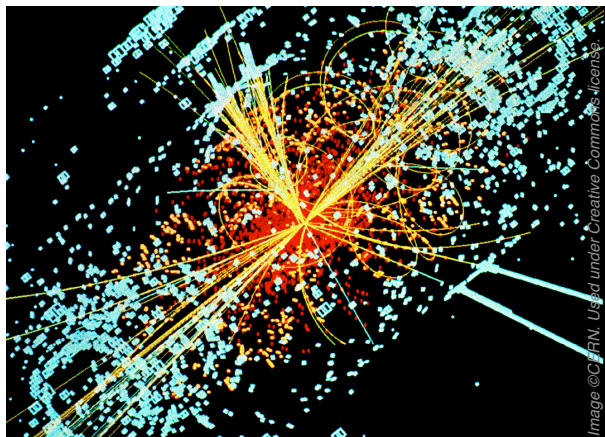
3. the elastic scattering of photons by high-energy photons (two words)
5. a theory that attempts to combine three fundamental forces (weak, strong, and electromagnetic) with gravity into a single theory (three words)
6. the wavelength associated with the motion of a particle possessing momentum of magnitude p (three words)
7. the property of matter that defines its dual nature of displaying both wave-like and particle-like characteristics (two words)
9. the theoretical basis of modern physics that explains the nature and behaviour of matter and energy at the atomic and subatomic levels (two words)
12. the smallest amount of energy that a particle can emit or absorb; the plural is quanta
13. the wave-like behaviour of particles with mass (two words)
14. a class of particles that includes the electron, the muon, the tauon, and the three types of neutrino; not composed of smaller particles

16. radiation emitted by an ideal blackbody (two words)
18. the minimum frequency at which electrons are ejected from a material (two words)
19. the modern theory of fundamental particles and their interactions (two words)
20. a particle that mediates the strong nuclear force
22. a constant that represents the ratio of the energy of a single quantum to its frequency (two words)
23. the theoretical particle thought to play a role in giving mass to other particles (two words)
24. the particle responsible for transmitting electromagnetic, strong, and weak forces
25. the phenomenon of electrons being ejected from a material when exposed to electromagnetic radiation (two words)

Down

1. a mathematical statement that says that if Δx is the uncertainty in a particle's position, and Δp is the uncertainty in its momentum, then $\Delta x \Delta p = h \div (4\pi)$, where h is Planck's constant (three words)
2. a fundamental particle that forms matter
4. a form of matter in which each particle has the same mass and an opposite charge as its counterpart in ordinary matter
8. a discrete bundle of energy carried by light
10. an elementary particle that makes up protons, neutrons, and other hadrons
11. an object that absorbs all radiation reaching it
15. the transformation of a photon into two particles with mass (two words)
17. the minimum energy needed to remove an electron bound to a metal surface (two words)
21. a class of particles that contains the neutron, the proton, and the pion; composed of combinations of quarks and anti-quarks





Unit 5

Revolutions in Modern Physics

Across

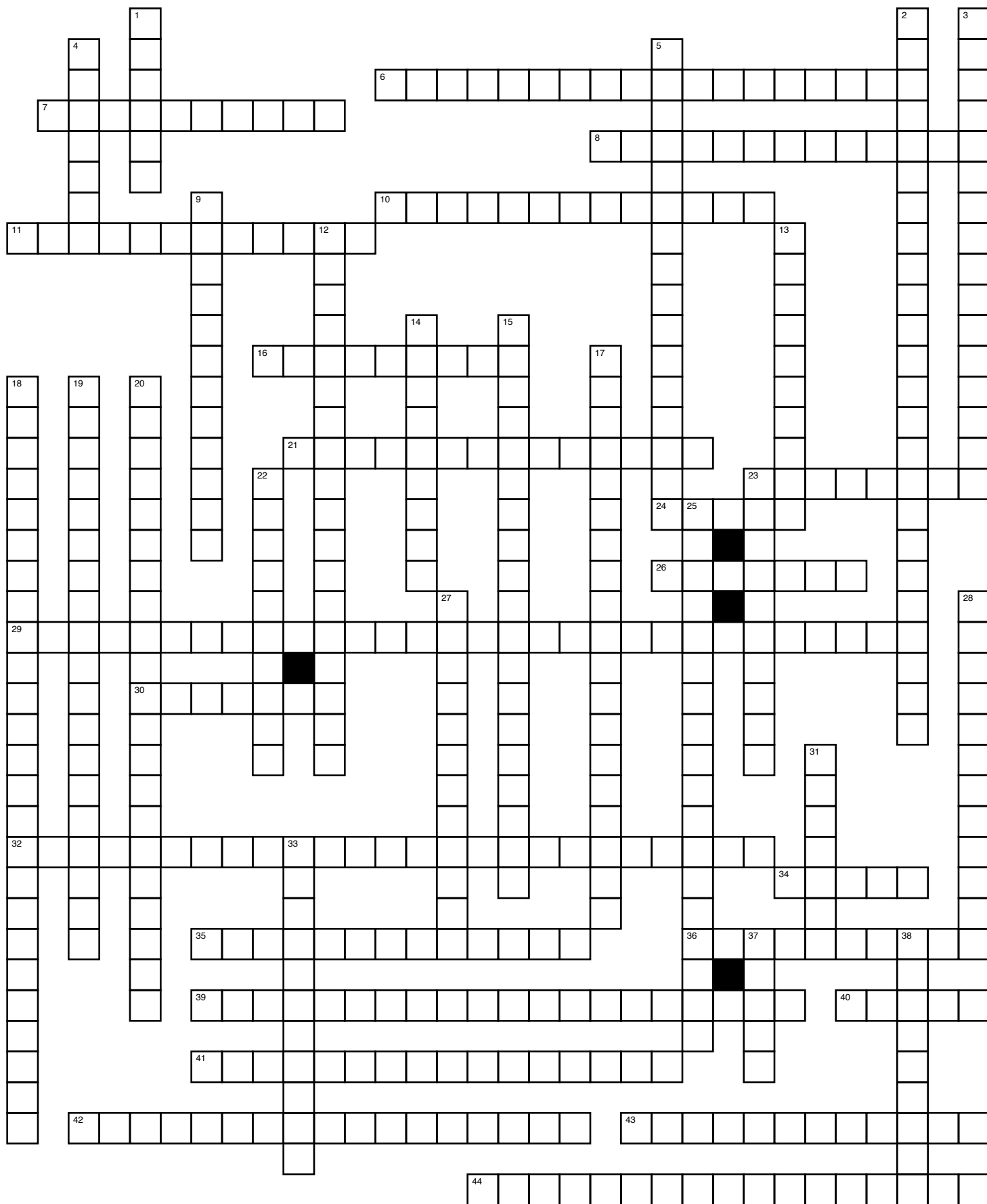
6. radiation emitted by an ideal blackbody (two words)
7. the wave-like behaviour of particles with mass (two words)
8. the elastic scattering of photons by high-energy photons (two words)
10. the modern theory of fundamental particles and their interactions (two words)
11. the occurrence of two or more events at the same time
16. a statement assumed to be true from which a theory is developed
21. a constant that represents the ratio of the energy of a single quantum to its frequency (two words)
23. the mass of an object measured at rest with respect to the observer; also called the proper mass (two words)
24. the proposed medium through which electromagnetic waves were once believed to propagate
26. a class of particles that includes the electron, the muon, the tauon, and the three types of neutrino; not composed of smaller particles
29. mathematical statement that says that if Δx is the uncertainty in a particle's position, and Δp is the uncertainty in its momentum, then $\Delta x \Delta p = h \div (4\pi)$, where h is Planck's constant (three words)
30. a fundamental particle that forms matter
32. the energy of an object in excess of its rest energy (three words)
34. the particle responsible for transmitting electromagnetic, strong, and weak forces
35. the theoretical basis of modern physics that explains the nature and behaviour of matter and energy at the atomic and subatomic levels (two words)
36. the theoretical particle thought to play a role in giving mass to other particles (two words)

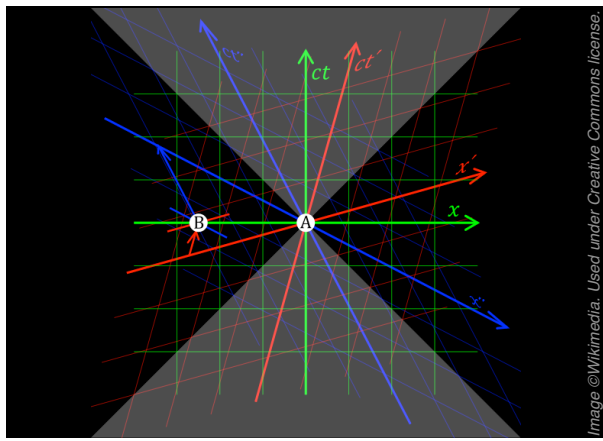
39. the momentum of objects moving at speeds near the speed of light (two words)
40. an elementary particle that makes up protons, neutrons, and other hadrons
41. time that is not absolute, but changes relative to the observer (two words)
42. the shortening of distances in an inertial frame of reference moving relative to an observer in another inertial frame of reference (two words)
43. the minimum energy needed to remove an electron bound to a metal surface (two words)
44. a mental exercise used to investigate the potential consequences of a hypothesis or postulate (two words)

Down

1. a discrete bundle of energy carried by light
2. the principle that rest mass and energy are equivalent (three words)
3. the mass of an object measured by an observer moving with speed v with respect to the object (two words)
4. the smallest amount of energy that a particle can emit or absorb; the plural is quanta
5. a coordinate system relative to which motion is described or observed (three words)
9. the transformation of a photon into two particles with mass (two words)
12. the minimum frequency at which electrons are ejected from a material (two words)
13. a form of matter in which each particle has the same mass and an opposite charge as its counterpart in ordinary matter
14. an object that absorbs all radiation reaching it
15. the wavelength associated with the motion of a particle possessing momentum of magnitude p (three words)

17. the phenomenon of electrons being ejected from a material when exposed to electromagnetic radiation (two words)
18. all physical laws are the same in all inertial frames of reference, and the speed of light is independent of the motion of the light source or its observer in all inertial frames of reference (four words)
19. the property of matter that defines its dual nature of displaying both wave-like and particle-like characteristics (two words)
20. the laws of motion are the same in all inertial frames (three words)
22. the time interval measured by an observer at rest with respect to a clock (two words)
23. the amount of energy an object at rest has with respect to an observer (two words)
25. a theory that attempts to combine three fundamental forces (weak, strong, and electromagnetic) with gravity into a single theory (three words)
27. the length of an object or distance between two points s measured by an observer who is stationary relative to the object or distance (two words)
28. the slowing down of time in one reference frame moving relative to an observer in another reference frame (two words)
31. a class of particles that contains the neutron, the proton, and the pion; composed of combinations of quarks and anti-quarks
33. a thought experiment in which a traveller in one frame of reference returns from a voyage to learn that time has passed more slowly in his spacecraft relative to the passage of time on Earth, despite the seemingly symmetric predictions of special relativity (two words)
37. a particle that mediates the strong nuclear force
38. a four-dimensional coordinate system in which the three space coordinates are combined with time, a fourth dimension



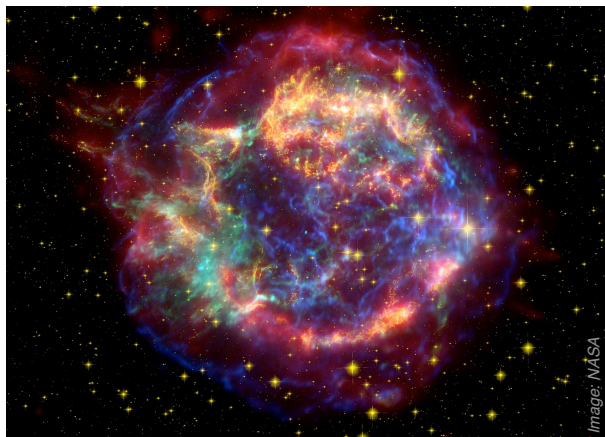


Chapter 11

Relativity

- ▶ a coordinate system relative to which motion is described or observed (three words)
- ▶ a frame of reference that moves at a zero or constant velocity; the law of inertia holds (four words)
- ▶ the laws of motion are the same in all inertial frames (three words)
- ▶ the proposed medium through which electromagnetic waves were once believed to propagate
- ▶ a mental exercise used to investigate the potential consequences of a hypothesis or postulate (two words)
- ▶ a statement assumed to be true from which a theory is developed
- ▶ all physical laws are the same in all inertial frames of reference, and the speed of light is independent of the motion of the light source or its observer in all inertial frames of reference (four words)
- ▶ the slowing down of time in one reference frame moving relative to an observer in another reference frame (two words)
- ▶ time that is not absolute, but changes relative to the observer (two words)
- ▶ the time interval measured by an observer at rest with respect to a clock (two words)
- ▶ the length of an object or distance between two points s measured by an observer who is stationary relative to the object or distance (two words)
- ▶ the shortening of distances in an inertial frame of reference moving relative to an observer in another inertial frame of reference (two words)
- ▶ the occurrence of two or more events at the same time
- ▶ a thought experiment in which a traveller in one frame of reference returns from a voyage to learn that time has passed more slowly in his spacecraft relative to the passage of time on Earth, despite the seemingly symmetric predictions of special relativity (two words)
- ▶ a four-dimensional coordinate system in which the three space coordinates are combined with time, a fourth dimension
- ▶ the momentum of objects moving at speeds near the speed of light (two words)
- ▶ the mass of an object measured at rest with respect to the observer; also called the proper mass (two words)
- ▶ the mass of an object measured by an observer moving with speed v with respect to the object (two words)
- ▶ the amount of energy an object at rest has with respect to an observer (two words)
- ▶ the energy of an object in excess of its rest energy (three words)
- ▶ the principle that rest mass and energy are equivalent (three words)

I	J	K	P	J	N	K	U	F	E	R	Q	D	W	Y	C	Q	A	F	U	B	O	E	G
R	R	T	B	F	Y	M	N	R	S	E	Z	J	G	R	B	B	A	F	Q	X	S	X	W
T	M	L	L	B	S	O	R	A	P	L	F	B	Q	P	W	R	O	Y	H	H	Z	C	M
D	S	O	Y	S	V	U	G	M	E	A	C	C	E	R	S	P	N	Z	R	K	C	N	H
Z	T	F	G	U	K	K	T	E	C	T	Z	X	Y	L	X	L	L	A	S	G	V	J	Y
X	N	K	R	Y	I	H	J	O	I	I	T	I	M	E	D	I	L	A	T	I	O	N	E
G	E	L	E	G	N	Y	B	F	A	V	V	S	P	A	C	E	T	I	M	E	I	N	Y
K	M	E	N	R	E	J	P	R	L	I	I	U	D	J	D	E	N	V	W	Y	Q	N	T
O	I	N	E	E	R	M	R	E	T	S	F	B	N	N	U	N	Y	C	Q	T	R	X	I
I	R	G	S	N	T	H	G	F	H	T	S	H	Y	F	U	C	C	E	I	I	L	I	V
X	E	T	S	E	I	R	W	E	E	I	Q	U	J	T	D	I	G	V	H	E	Z	P	I
O	P	H	A	C	A	S	P	R	O	C	J	W	S	G	P	G	K	N	J	N	E	R	T
D	X	C	M	I	L	S	E	E	R	M	Z	M	K	X	G	O	W	H	P	A	J	O	A
A	E	O	F	T	F	A	M	N	Y	O	M	R	A	Z	H	C	X	R	C	T	Q	P	L
R	T	N	O	E	R	M	I	C	O	M	I	R	J	R	Q	Z	O	E	K	L	E	E	E
A	H	T	N	N	A	C	T	E	F	E	E	E	G	M	F	P	P	S	S	U	E	R	R
P	G	R	O	I	M	I	C	F	R	N	H	B	U	V	E	L	F	T	O	M	R	L	F
N	U	A	I	K	E	T	I	Z	E	T	Z	U	G	R	S	P	D	E	Y	I	H	E	O
I	O	C	T	C	O	S	T	Q	L	U	A	D	T	C	X	H	O	N	J	S	N	N	E
W	H	T	A	I	F	I	S	G	A	M	L	I	D	J	R	W	Z	E	Q	Y	L	G	L
T	T	I	V	T	R	V	I	D	T	X	M	W	P	X	Y	H	N	R	E	T	F	T	P
C	E	O	R	S	E	I	V	W	I	E	M	G	D	E	U	H	R	G	B	G	F	H	I
Q	T	N	E	I	F	T	I	X	V	A	Q	A	X	H	T	E	U	Y	N	M	E	K	C
Q	A	Q	S	V	E	A	T	R	I	U	M	X	S	P	S	H	W	L	J	Z	D	F	N
Y	L	H	N	I	R	L	A	C	T	U	X	O	X	T	M	E	E	E	F	N	B	V	I
H	U	D	O	T	E	E	L	D	Y	E	N	F	M	Y	P	P	F	R	S	D	L	J	R
G	T	K	C	A	N	R	E	W	D	Z	H	A	X	C	Q	S	A	U	G	P	V	Z	P
U	S	F	B	L	C	I	R	N	Y	R	S	C	S	V	Y	A	S	T	U	L	Y	U	M
Q	O	R	C	E	E	E	E	M	A	S	O	M	N	H	E	O	T	V	O	G	R	R	B
T	P	V	Y	R	E	D	F	D	S	Y	W	R	J	S	V	A	T	I	E	B	S	A	N

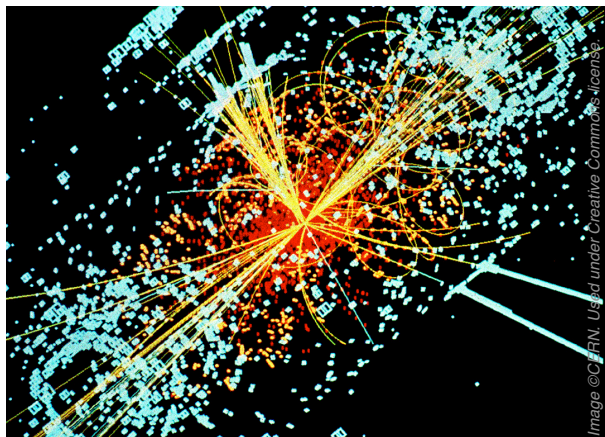


Chapter 12

Quantum Mechanics

- ▶ the smallest amount of energy that a particle can emit or absorb; the plural is quanta
- ▶ the theoretical basis of modern physics that explains the nature and behaviour of matter and energy at the atomic and subatomic levels (two words)
- ▶ the property of matter that defines its dual nature of displaying both wave-like and particle-like characteristics (two words)
- ▶ the minimum energy needed to remove an electron bound to a metal surface (two words)
- ▶ the phenomenon of electrons being ejected from a material when exposed to electromagnetic radiation (two words)
- ▶ the minimum frequency at which electrons are ejected from a material (two words)
- ▶ a discrete bundle of energy carried by light
- ▶ a constant that represents the ratio of the energy of a single quantum to its frequency (two words)
- ▶ the elastic scattering of photons by high-energy photons (two words)
- ▶ the transformation of a photon into two particles with mass (two words)
- ▶ an object that absorbs all radiation reaching it
- ▶ radiation emitted by an ideal blackbody (two words)
- ▶ the wavelength associated with the motion of a particle possessing momentum of magnitude p (three words)
- ▶ the wave-like behaviour of particles with mass (two words)
- ▶ a mathematical statement that says that if Δx is the uncertainty in a particle's position, and Δp is the uncertainty in its momentum, then $\Delta x \Delta p = h \div (4\pi)$, where h is Planck's constant (three words)
- ▶ a form of matter in which each particle has the same mass and an opposite charge as its counterpart in ordinary matter
- ▶ an elementary particle that makes up protons, neutrons, and other hadrons
- ▶ a class of particles that contains the neutron, the proton, and the pion; composed of combinations of quarks and anti-quarks
- ▶ a class of particles that includes the electron, the muon, the tauon, and the three types of neutrino; not composed of smaller particles
- ▶ the modern theory of fundamental particles and their interactions (two words)
- ▶ a fundamental particle that forms matter
- ▶ the particle responsible for transmitting electromagnetic, strong, and weak forces
- ▶ a particle that mediates the strong nuclear force
- ▶ the theoretical particle thought to play a role in giving mass to other particles (two words)
- ▶ a theory that attempts to combine three fundamental forces (weak, strong, and electromagnetic) with gravity into a single theory (three words)

R	T	N	U	C	D	T	Z	H	P	C	H	Z	H	N	E	B	C	N	B	T	Y	U	B
D	Q	I	T	Q	O	U	Y	E	Y	C	F	W	Y	O	G	X	J	O	L	X	R	Y	X
F	E	T	B	Q	K	X	E	I	Z	R	M	N	U	P	C	L	B	S	A	G	O	Y	P
Y	W	F	F	F	P	N	B	S	B	S	L	H	C	Y	E	B	O	O	C	M	E	T	A
A	G	U	L	D	U	O	G	E	N	T	L	D	N	C	W	F	S	B	K	O	H	V	N
L	S	V	N	D	H	I	K	N	A	L	Q	H	W	N	C	Z	O	S	B	S	T	P	T
Q	A	W	M	U	M	M	T	B	W	U	O	K	A	E	Z	N	N	G	O	K	M	A	I
Z	R	S	T	K	M	R	K	E	O	Q	Q	P	S	U	V	X	C	G	D	L	U	L	M
O	A	H	X	X	F	E	C	R	I	Z	T	Z	Q	Q	B	A	B	I	Y	T	T	E	A
B	G	G	L	S	X	F	P	G	S	Z	N	E	B	E	E	G	W	H	T	Q	N	D	T
O	N	L	N	I	P	O	Q	U	A	N	T	U	M	R	H	I	I	R	E	T	A	O	T
F	O	G	U	W	K	I	U	N	B	Z	D	Z	L	F	N	I	L	A	E	G	U	M	E
A	T	U	V	O	A	T	I	C	W	S	L	J	G	D	Q	T	A	V	W	T	Q	D	R
P	O	H	T	G	N	E	L	E	V	A	W	E	I	L	G	O	R	B	E	D	T	R	Y
A	H	Z	X	P	U	X	I	R	P	P	Z	U	J	O	B	S	U	T	I	P	C	A	S
I	P	L	U	N	T	K	T	T	X	J	Y	C	P	H	U	T	Q	J	D	I	N	D	M
R	W	Y	F	Q	N	P	Z	A	C	L	I	B	T	S	F	Z	P	U	D	L	U	N	X
C	W	C	T	C	Q	D	H	I	Y	A	X	O	N	E	V	K	M	W	A	B	O	A	K
R	O	F	M	D	N	F	M	N	R	I	S	S	R	R	P	V	B	I	D	R	Z	T	H
E	R	K	W	S	S	N	O	T	P	E	L	N	A	H	Y	Q	M	D	O	H	K	S	M
A	K	G	O	O	R	B	O	Y	F	B	T	H	U	T	F	H	A	D	R	O	N	S	R
T	F	K	R	D	J	U	V	P	N	D	N	B	A	K	M	H	O	D	X	P	W	C	U
I	U	E	B	T	H	E	O	R	Y	O	F	E	V	E	R	Y	T	H	I	N	G	K	R
O	N	V	D	V	Q	H	D	I	U	U	C	E	G	A	P	Y	Z	X	L	N	X	H	C
N	C	G	C	F	N	T	W	N	P	L	A	N	K	S	C	O	N	S	T	A	N	T	X
G	T	T	C	E	F	F	E	C	I	R	T	C	E	L	E	O	T	O	H	P	V	S	R
V	I	L	I	M	M	N	O	I	T	A	I	D	A	R	Y	D	O	B	K	C	A	L	B
E	O	C	W	W	A	V	E	P	A	R	T	I	C	L	E	D	U	A	L	I	T	Y	O
T	N	F	V	U	X	G	G	L	G	U	T	C	E	F	F	E	N	O	T	P	M	O	C
C	B	N	B	X	P	M	E	E	J	U	W	E	X	H	T	V	W	G	L	G	K	L	E



Unit 5

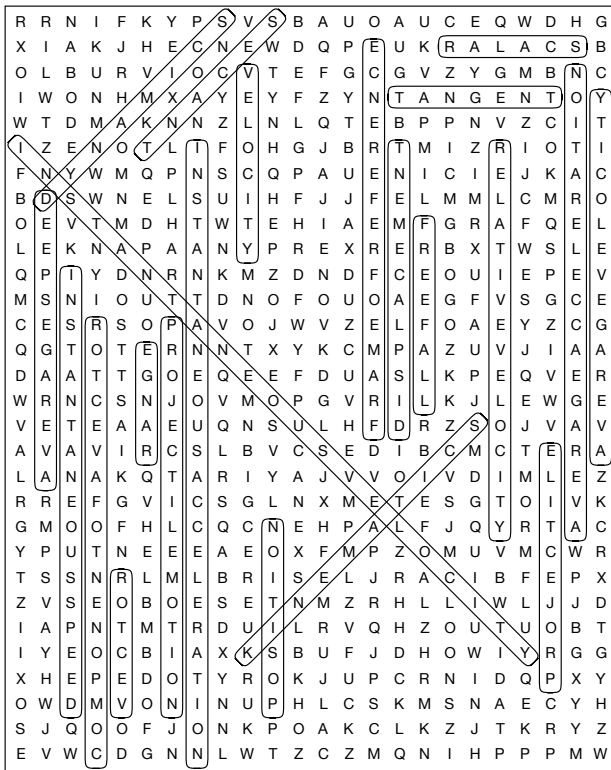
Revolutions in Modern Physics

- ▶ a coordinate system relative to which motion is described or observed (three words)
- ▶ a frame of reference that moves at a zero or constant velocity; the law of inertia holds (four words)
- ▶ the laws of motion are the same in all inertial frames (three words)
- ▶ the proposed medium through which electromagnetic waves were once believed to propagate
- ▶ a mental exercise used to investigate the potential consequences of a hypothesis or postulate (two words)
- ▶ a statement assumed to be true from which a theory is developed
- ▶ all physical laws are the same in all inertial frames of reference, and the speed of light is independent of the motion of the light source or its observer in all inertial frames of reference (four words)
- ▶ the slowing down of time in one reference frame moving relative to an observer in another reference frame (two words)
- ▶ time that is not absolute, but changes relative to the observer (two words)
- ▶ the time interval measured by an observer at rest with respect to a clock (two words)
- ▶ the length of an object or distance between two points s measured by an observer who is stationary relative to the object or distance (two words)
- ▶ the shortening of distances in an inertial frame of reference moving relative to an observer in another inertial frame of reference (two words)
- ▶ the occurrence of two or more events at the same time
- ▶ a thought experiment in which a traveller in one frame of reference returns from a voyage to learn that time has passed more slowly in his spacecraft relative to the passage of time on Earth, despite the seemingly symmetric predictions of special relativity (two words)
- ▶ a four-dimensional coordinate system in which the three space coordinates are combined with time, a fourth dimension
- ▶ the momentum of objects moving at speeds near the speed of light (two words)
- ▶ the mass of an object measured at rest with respect to the observer; also called the proper mass (two words)
- ▶ the mass of an object measured by an observer moving with speed v with respect to the object (two words)
- ▶ the amount of energy an object at rest has with respect to an observer (two words)
- ▶ the energy of an object in excess of its rest energy (three words)
- ▶ the principle that rest mass and energy are equivalent (three words)
- ▶ the smallest amount of energy that a particle can emit or absorb; the plural is quanta
- ▶ the theoretical basis of modern physics that explains the nature and behaviour of matter and energy at the atomic and subatomic levels (two words)
- ▶ the property of matter that defines its dual nature of displaying both wave-like and particle-like characteristics (two words)
- ▶ the minimum energy needed to remove an electron bound to a metal surface (two words)
- ▶ the phenomenon of electrons being ejected from a material when exposed to electromagnetic radiation (two words)
- ▶ the minimum frequency at which electrons are ejected from a material (two words)
- ▶ a discrete bundle of energy carried by light
- ▶ a constant that represents the ratio of the energy of a single quantum to its frequency (two words)
- ▶ the elastic scattering of photons by high-energy photons (two words)
- ▶ the transformation of a photon into two particles with mass (two words)
- ▶ an object that absorbs all radiation reaching it
- ▶ radiation emitted by an ideal blackbody (two words)
- ▶ the wavelength associated with the motion of a particle possessing momentum of magnitude p (three words)
- ▶ the wave-like behaviour of particles with mass (two words)
- ▶ a mathematical statement that says that if Δx is the uncertainty in a particle's position, and Δp is the uncertainty in its momentum, then $\Delta x \Delta p \geq \frac{h}{4\pi}$, where h is Planck's constant (three words)
- ▶ a form of matter in which each particle has the same mass and an opposite charge as its counterpart in ordinary matter
- ▶ an elementary particle that makes up protons, neutrons, and other hadrons
- ▶ a class of particles that contains the neutron, the proton, and the pion; composed of combinations of quarks and anti-quarks
- ▶ a class of particles that includes the electron, the muon, the tauon, and the three types of neutrino; not composed of smaller particles
- ▶ the modern theory of fundamental particles and their interactions (two words)
- ▶ a fundamental particle that forms matter
- ▶ the particle responsible for transmitting electromagnetic, strong, and weak forces
- ▶ a particle that mediates the strong nuclear force
- ▶ the theoretical particle thought to play a role in giving mass to other particles (two words)
- ▶ a theory that attempts to combine three fundamental forces (weak, strong, and electromagnetic) with gravity into a single theory (three words)

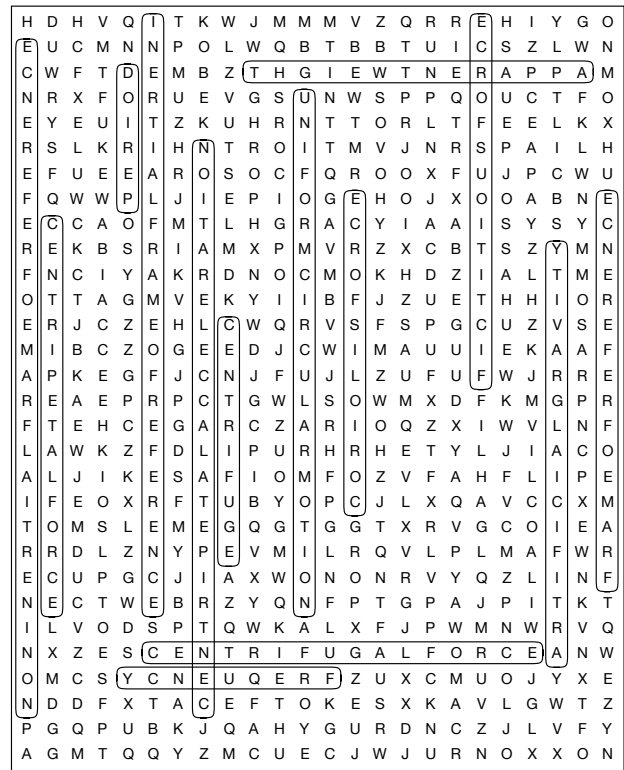
R	Z	N	D	J	V	H	K	A	H	C	B	I	W	U	H	T	G	N	E	L	R	E	P	O	R	P	C	T	T	U	A
L	E	R	V	Y	M	U	T	N	A	U	Q	J	G	V	O	W	V	D	I	M	V	B	R	R	R	R	C	G	V	Y	Z
S	G	L	N	X	T	A	V	E	S	G	C	O	L	C	K	G	M	P	L	F	H	E	U	Q	C	Z	E	T	P	A	R
F	N	O	I	T	A	I	D	A	R	Y	D	O	B	K	C	A	L	B	X	F	H	P	Z	K	M	U	V	C	H	W	R
T	S	V	X	Y	L	G	E	B	R	I	L	Q	L	S	S	A	M	C	I	T	S	I	V	I	T	A	L	E	R	I	U
H	E	P	U	C	Z	R	H	N	L	O	W	E	U	J	R	E	S	T	E	N	E	R	G	Y	U	C	I	F	V	Q	C
O	O	E	K	N	V	B	T	I	A	V	S	Y	P	R	N	X	W	Z	B	U	F	J	D	H	O	S	I	F	D	G	O
U	H	C	T	E	D	L	K	Y	R	T	K	J	U	T	C	R	N	I	D	Q	A	X	Y	O	E	Y	U	E	O	H	N
G	U	N	H	U	C	S	B	M	S	N	L	E	C	Y	O	S	J	Q	S	O	F	J	Q	N	G	W	O	C	K	C	S
H	Z	E	T	Q	R	Y	O	E	V	W	T	U	G	N	Q	N	W	T	Z	C	Z	M	B	R	A	H	P	I	Y	M	E
T	B	R	O	E	M	S	S	M	O	J	W	B	M	I	Y	M	S	T	L	X	L	E	E	V	N	O	X	R	T	S	R
E	V	E	S	R	D	S	O	U	P	O	I	L	L	I	J	O	V	W	O	E	R	N	E	O	T	G	D	T	I	M	V
X	O	F	P	F	O	A	N	G	T	E	N	A	H	O	S	J	B	L	D	G	E	P	S	B	Q	E	H	C	V	O	A
P	K	E	A	D	V	M	S	C	O	G	P	C	Z	Y	S	G	Y	O	U	C	A	O	N	W	B	X	K	E	I	H	T
E	R	R	C	L	F	T	U	H	R	Q	A	K	S	W	Q	T	M	N	I	R	B	T	J	R	Y	S	L	L	T	Q	I
R	T	F	E	O	T	S	L	X	H	Y	R	B	Q	K	W	D	C	T	T	S	W	C	O	N	P	T	D	E	A	F	O
I	I	O	T	H	W	E	W	N	Q	R	A	O	P	X	R	E	E	I	G	Q	U	G	O	E	H	Q	R	O	L	F	N
M	M	E	I	S	I	R	W	V	E	K	D	D	E	A	R	N	C	G	U	E	L	R	C	A	Z	X	L	T	E	J	O
E	E	M	M	E	I	J	U	I	I	D	O	Y	D	T	I	L	I	A	E	I	L	I	H	U	P	B	L	O	R	T	F
N	D	A	E	R	B	X	W	B	D	A	X	N	A	K	E	H	R	S	E	E	A	L	O	D	P	S	X	H	F	T	M
T	I	R	R	H	W	B	K	T	Y	K	A	I	C	D	J	K	Y	W	N	L	L	Y	R	L	K	P	A	P	O	P	A
H	L	F	U	T	L	M	E	A	J	T	N	I	U	U	M	Z	A	G	T	F	X	N	V	T	U	X	F	X	E	O	S
S	A	L	I	O	U	B	A	X	S	T	T	A	F	F	Z	V	T	H	E	T	X	K	N	O	T	O	H	P	L	E	S
U	T	A	U	V	G	S	K	M	Y	S	L	E	M	K	E	H	E	B	S	U	N	B	K	G	K	O	R	B	P	T	E
D	I	I	N	F	Y	K	G	P	I	I	R	B	C	L	C	O	J	N	O	U	L	G	O	X	B	X	T	Q	I	A	N
S	O	T	X	J	N	D	R	V	T	M	T	H	E	O	R	Y	O	F	E	V	E	R	Y	T	H	I	N	G	C	L	E
L	N	R	H	U	B	I	I	Y	I	P	U	N	N	Y	Y	V	M	S	C	Q	E	I	I	J	K	O	E	F	N	U	R
F	T	E	Z	N	N	T	G	O	U	V	G	T	O	D	O	A	S	N	O	R	D	A	H	T	I	Z	W	D	I	T	G
F	U	N	Z	C	A	D	N	O	T	T	R	F	O	X	T	D	A	A	N	T	I	M	A	T	T	E	R	S	R	S	Y
Q	G	I	I	L	O	I	M	K	H	A	R	U	B	T	T	J	L	Q	F	E	Y	I	E	Z	I	O	U	Z	P	O	T
Q	S	P	E	S	K	B	L	U	C	E	Q	Y	E	Q	R	P	S	A	N	I	P	V	S	F	K	A	D	D	W	P	V
U	L	R	I	U	W	R	E	T	L	O	T	R	E	V	J	T	C	E	F	F	E	N	O	T	P	M	O	C	E	H	K
E	F	W	X	S	K	J	I	A	J	O	W	Z	X	P	L	A	N	K	S	C	O	N	S	T	A	N	T	R	B	Q	F
S	U	R	C	Q	B	O	T	U	R	A	R	E	L	A	T	I	V	I	S	T	I	C	M	O	M	E	N	T	U	M	X
T	H	A	V	H	N	I	O	D	V	X	T	H	O	Q	O	J	N	K	H	Z	E	M	I	T	R	E	P	O	R	P	F
Q	T	O	K	N	V	V	C	E	Z	N	W	E	F	P	A	I	R	C	R	E	A	T	I	O	N	T	Y	N	J	O	W
Z	B	Y	B	I	T	M	S	K	Z	N	X	H	I	Q	E	F	R	A	M	E	O	F	R	E	F	E	R	E	N	C	E
Y	B	R	T	U	X	S	R	Z	I	C	U	D	R	E	L	A	T	I	V	I	S	T	I	C	T	I	M	E	Y	S	H
D	J	Y	M	H	U	N	D	G	U	F	U	X	O	L	M	V	X	F	N	D	H	K	B	A	K	T	H	V	S	P	Y
G	N	O	I	T	C	N	U	F	K	R	O	W	E	Y	R	O	E	H	T	M	U	T	N	A	U	Q	D	B	D	J	I

[illegible][illegible][illegible][illegible]

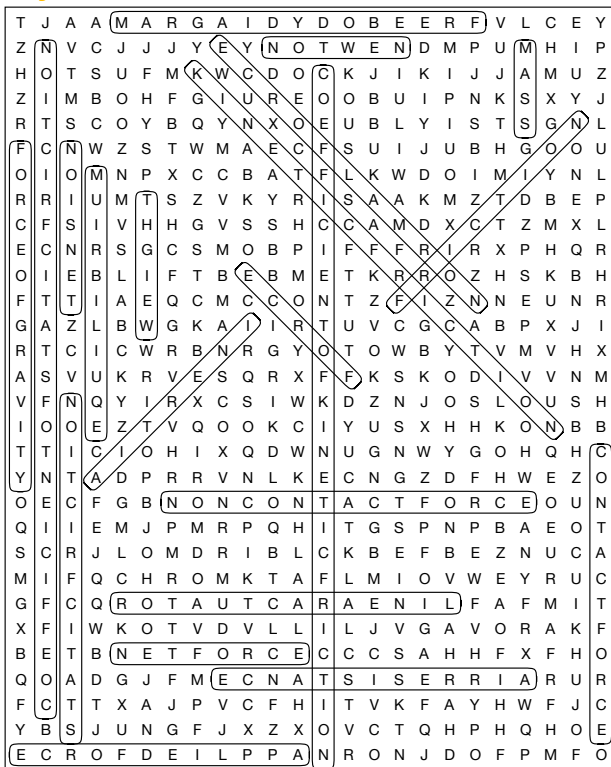
Kinematics



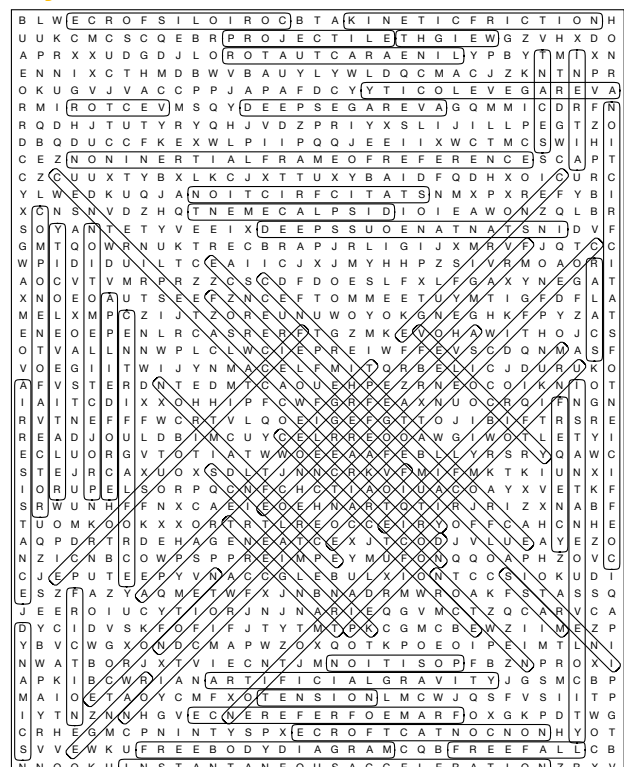
Uniform Circular Motion



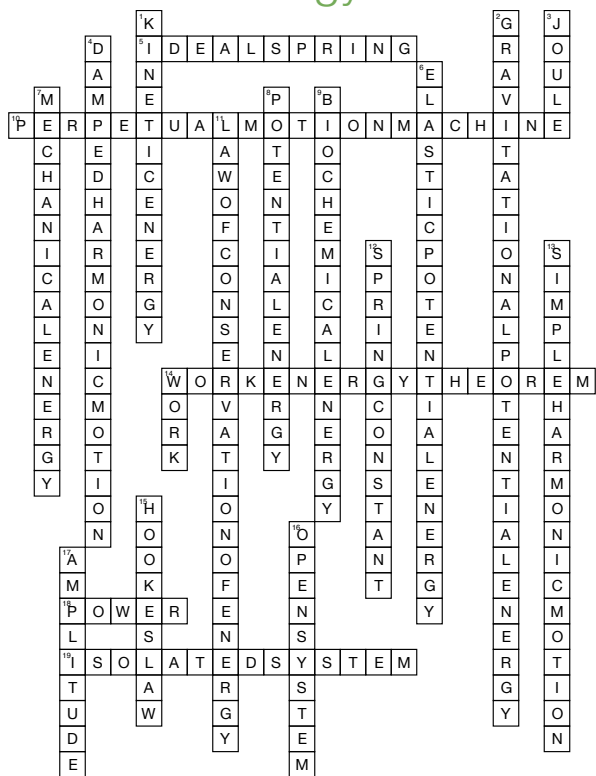
Dynamics



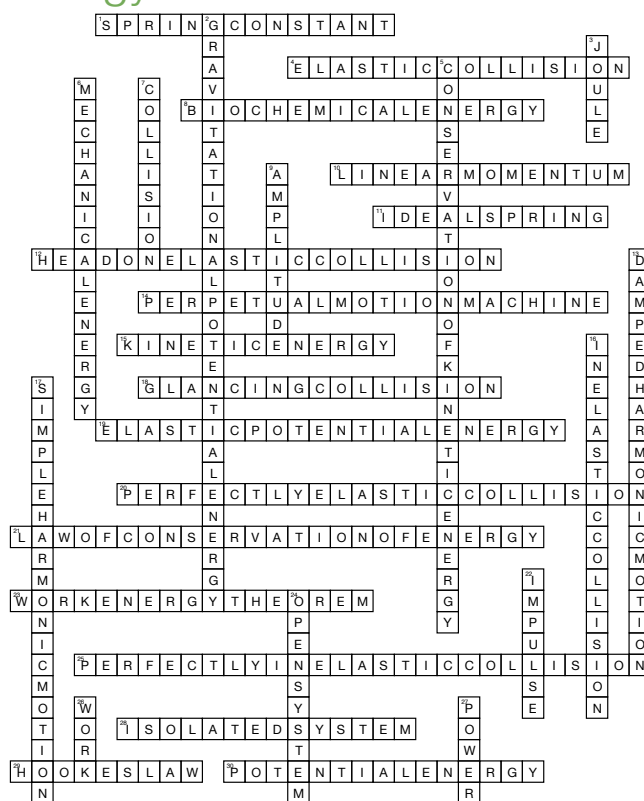
Dynamics



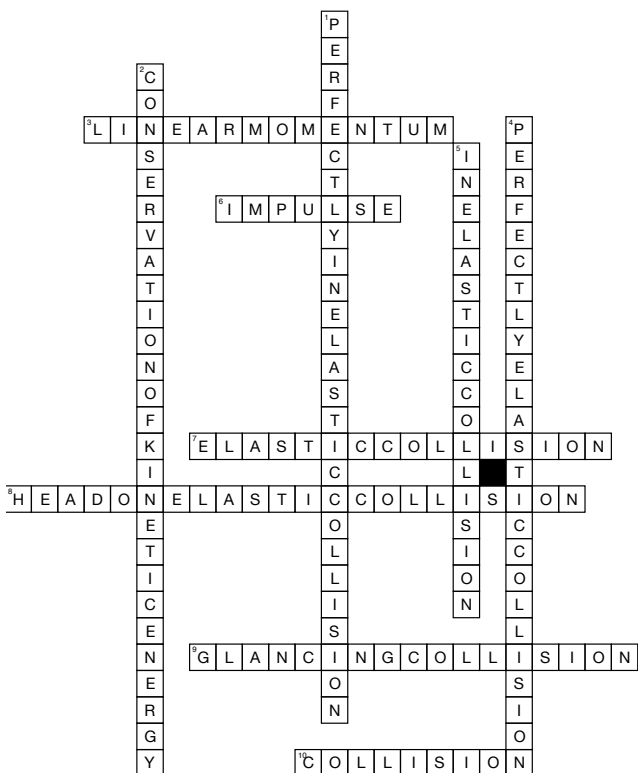
Work and Energy



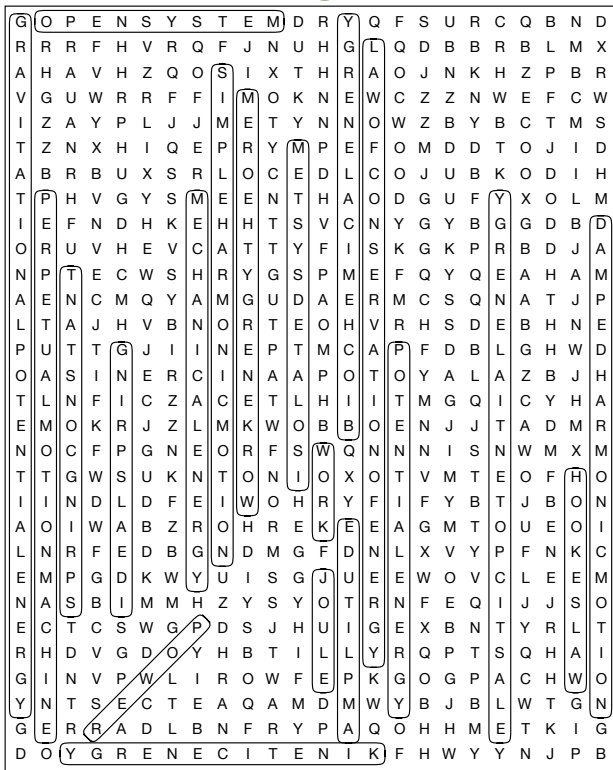
Energy and Momentum



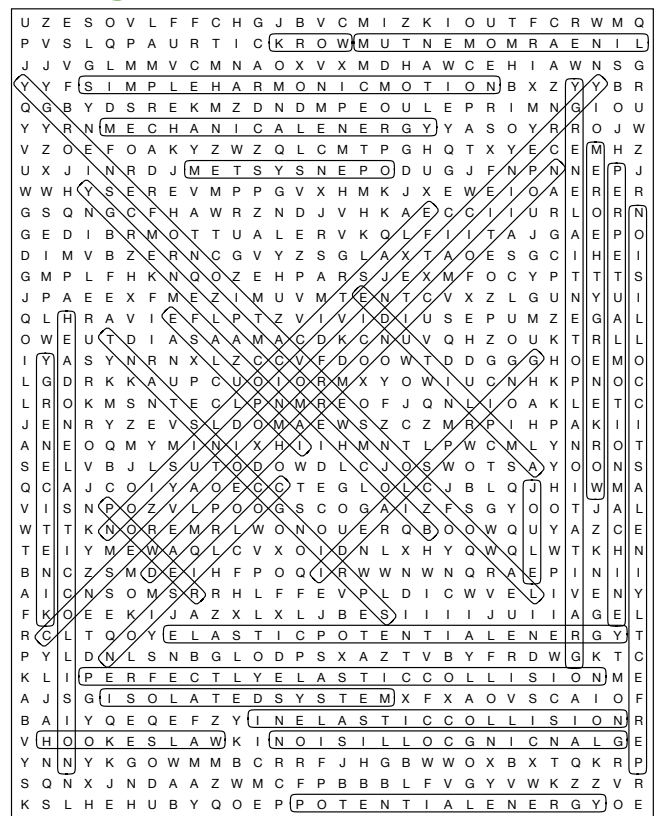
Momentum and Collisions



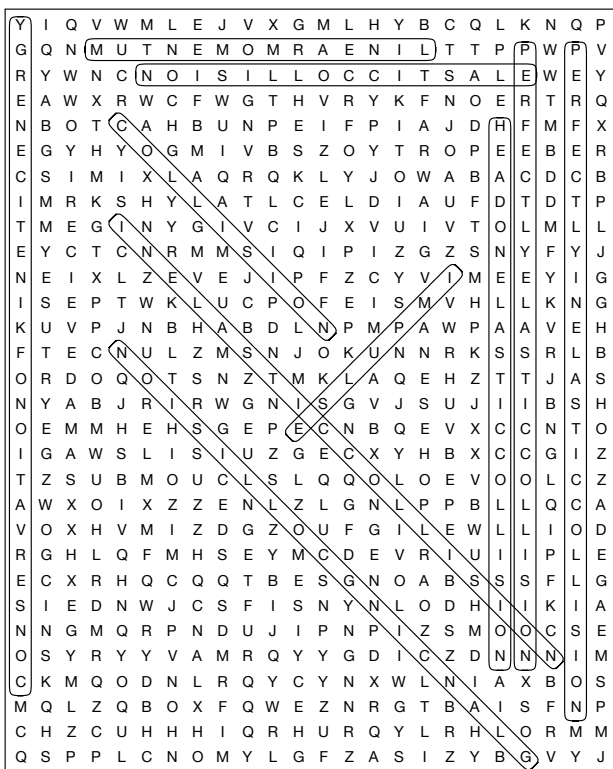
Work and Energy



Energy and Momentum



Momentum and Collisions



10

1 G
R
A
V
I
T
A
T
I
O
N
A
L
C
O
N
S
T
A
N
T

2 U
N
I
V
E
R
S
A

3 G
R
A
V
I
T
Y

4 I
N
T
E
R
P
L
A
N
E
T
A
R
Y

5 G
R
A
V
I
T
A
T
I
O
N
A
L
C
O
N
S
T
A
N
T

6 A
R
T
I
F
I
C
I
A
L
S
A
T
E
L
L
I
T
E

7 S
A
T
E
L
L
I
T
E

8 S
P
A
C
E
S
T
A
T
I
O
N

9 G
E
O
S
Y
N
C
H
R
O
N
O
U
S
O
R
B
I
T

[illegible][illegible][illegible]

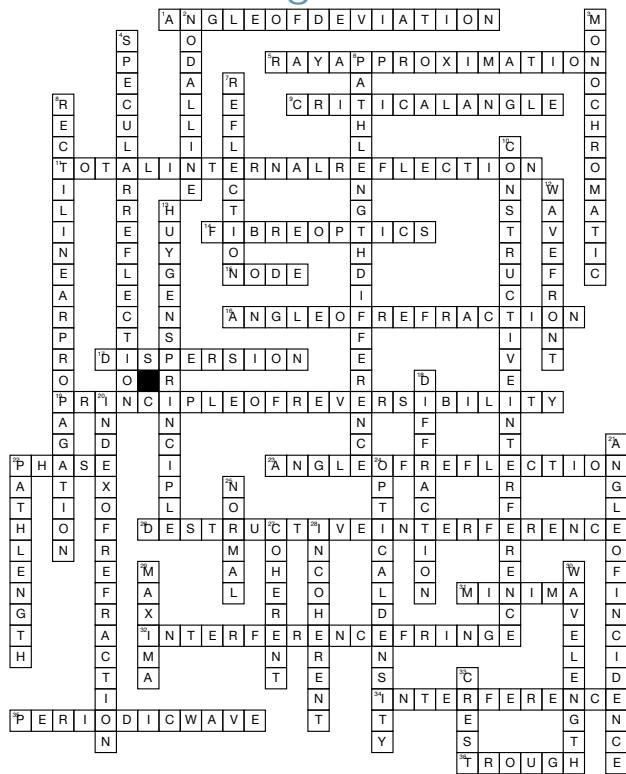
Y	C	H	F	M	L	X	M	I	Q	E	D	G	J	G	K	G	E	E	J	M	D	M	E	
D	X	Q	J	M	R	C	T	Z	G	N	T	A	W	J	G	M	E	H	E	J	H	M	T	X
I	H	D	P	J	T	V	W	G	G	L	N	X	W	Y	K	S	O	H	Y	R	S	G	H	I
S	T	U	A	S	K	C	M	W	U	O	R	V	P	B	V	Q	S	Y	F	J	H	M	T	
Z	G	N	Q	S	H	Y	H	U	N	O	B	E	V	B	V	S	Y	E	S	Z	R	S	E	
A	N	E	A	M	H	I	S	Y	I	V	X	E	I	N	E	N	Y	Y	V	M	U	X	T	
W	E	M	A	T	P	T	X	Y	V	L	R	V	N	V	V	C	F	O	U	I	F	I	Y	
H	R	A	U	Y	S	K	I	H	E	H	C	O	X	K	O	H	L	A	K	F	C	L	J	
A	T	F	J	O	R	N	G	M	R	H	I	I	N	V	S	R	W	C	O	C	N	W	L	
I	S	K	D	F	O	O	R	S	T	S	P	U	B	C	O	U	T	W	Y	F	E	N		
R	D	A	O	P	L	D	S	C	A	I	C	K	Z	V	I	N	D	U	D	Q	R	T	C	
U	L	P	C	X	E	I	V	T	L	Z	C	I	S	F	Y	O	L	B	V	J	I	A	A	
W	E	M	C	K	C	U	S	Z	L	A	G	O	D	K	X	U	E	W	J	N	L	S	I	
A	I	P	G	M	T	E	L	U	A	B	N	T	F	C	C	S	I	B	L	C	N	L	K	
L	F	B	Y	Q	C	H	M	G	W	H	L	O	R	Q	D	O	F	P	O	Z	N	A	C	
E	L	Y	S	A	A	H	T	F	O	K	P	F	I	O	V	R	L	L	I	Q	J	I	O	
R	A	V	P	J	H	U	V	F	G	M	H	I	A	T	X	B	A	I	K	P	T	C	Y	
A	N	S	T	A	P	V	R	N	G	J	Y	S	S	K	A	I	N	Y	W	U	V	I	N	
U	O	S	J	Y	G	V	B	K	R	U	G	X	Q	K	F	T	O	S	T	W	D	F	M	
Q	I	D	K	C	W	G	I	E	A	G	K	F	W	K	M	S	I	W	K	R	G	I	Y	
S	T	S	A	C	J	X	T	X	V	Y	A	V	Y	V	Z	G	T	V	W	S	G	T	X	
E	A	A	V	M	X	T	A	W	I	E	Q	C	Y	R	O	K	A	F	A	F	Q	R	V	
S	T	T	T	T	Q	X	L	Q	T	V	L	O	R	M	K	N	T	A	H	R	O	A	S	
R	E	V	L	E	N	C	H	V	R	A	D	T	O	Q	W	R	A	F	V	L	B	U	X	
V	A	L	O	V	C	R	I	D	K	I	O	H	O	A	R	K	F	A	S	E	Y	R	V	
N	I	R	I	A	X	N	F	I	U	E	L	X	E	O	P	P	N	R	E	B	G	K	A	
I	G	E	T	R	T	X	F	U	E	N	O	P	B	G	L	K	N	B	M	U	A	K	R	
R	Q	E	Y	H	N	M	S	J	S	Q	D	Q	D	R	K	M	R	L	R	U	X	P	R	
T	D	V	O	L	F	H	N	Y	T	F	O	Q	I	H	R	X	K	Z	O	C	B	V	W	

H	D	H	N	Q	M	T	K	W	J	M	M	V	Z	Q	R	M	H	I	Y	G	O
L	U	C	O	N	R	P	O	L	W	Q	B	T	B	T	U	I	Y	S	Z	L	W
M	W	F	I	U	Z	M	B	Z	E	R	W	C	C	S	P	O	H	L	A	N	I
I	R	X	T	P	V	U	E	V	G	S	G	N	W	S	P	P	Q	Z	U	C	F
S	Y	E	A	Y	M	Z	K	U	H	R	W	T	T	O	R	L	T	O	E	E	L
Q	S	L	C	A	H	C	H	T	R	O	L	T	M	V	J	N	R	K	P	A	I
U	F	U	I	T	G	R	I	S	O	C	E	Q	R	O	O	X	F	T	J	P	S
R	Q	W	F	R	N	J	U	E	P	I	Y	G	N	H	O	J	X	L	O	L	B
E	W	C	I	O	E	M	R	L	H	G	E	A	O	Y	I	A	A	G	A	L	S
C	E	K	T	S	T	I	G	M	X	P	U	S	Z	X	C	B	L	S	Z	S	
E	U	C	N	Y	O	K	N	D	N	O	F	M	Z	K	H	D	Z	K	Y	L	
Q	F	T	E	G	R	M	N	K	Y	I	N	B	V	J	Z	U	E	R	H	H	
L	P	J	D	Z	H	A	N	C	W	Q	H	V	J	F	S	P	O	F	U	Z	
L	X	B	I	Z	E	G	A	S	T	D	J	U	M	M	A	E	U	O	E	K	
P	M	K	Y	G	O	N	L	O	J	F	I	J	Z	Z	H	F	U	U	W	J	
L	E	A	C	P	L	E	K	H	G	W	L	S	E	T	M	X	D	F	K	M	
Z	X	E	N	C	O	T	R	C	K	C	Z	H	R	D	O	Q	Z	X	I	W	
R	Y	W	E	Z	G	I	R	A	P	U	D	L	P	H	E	T	Y	L	J	I	
G	T	J	U	K	I	C	F	K	I	O	E	F	C	Z	V	F	A	H	V	L	
P	J	E	Q	X	C	F	A	O	B	I	X	P	D	J	L	X	Q	A	F	C	
E	X	M	E	L	A	I	R	A	F	G	M	G	G	T	X	R	V	G	C	O	
H	K	D	R	Z	L	E	H	K	V	M	F	L	R	Q	V	L	P	L	M	A	
F	D	U	F	G	F	L	N	A	X	W	V	N	O	N	R	V	Y	Q	Z	L	
L	V	C	O	W	L	D	L	B	Z	Y	Q	O	F	T	G	P	A	J	P	I	
F	L	V	I	D	U	L	L	Q	W	K	A	L	X	F	J	P	W	M	N	W	
A	X	Z	D	S	I	I	S	N	F	M	J	P	G	P	E	X	R	H	Y	F	
O	M	C	A	J	D	E	N	M	F	J	G	S	G	Z	U	X	C	M	U	O	
O	D	D	X	T	E	X	E	F	T	O	K	E	S	X	K	A	V	L	G	W	
P	G	Q	P	U	B	K	J	Q	A	H	Y	G	U	R	D	N	C	Z	J	L	
A	G	M	T	P	Q	Y	Z	M	C	U	E	C	J	W	J	U	R	N	O	X	

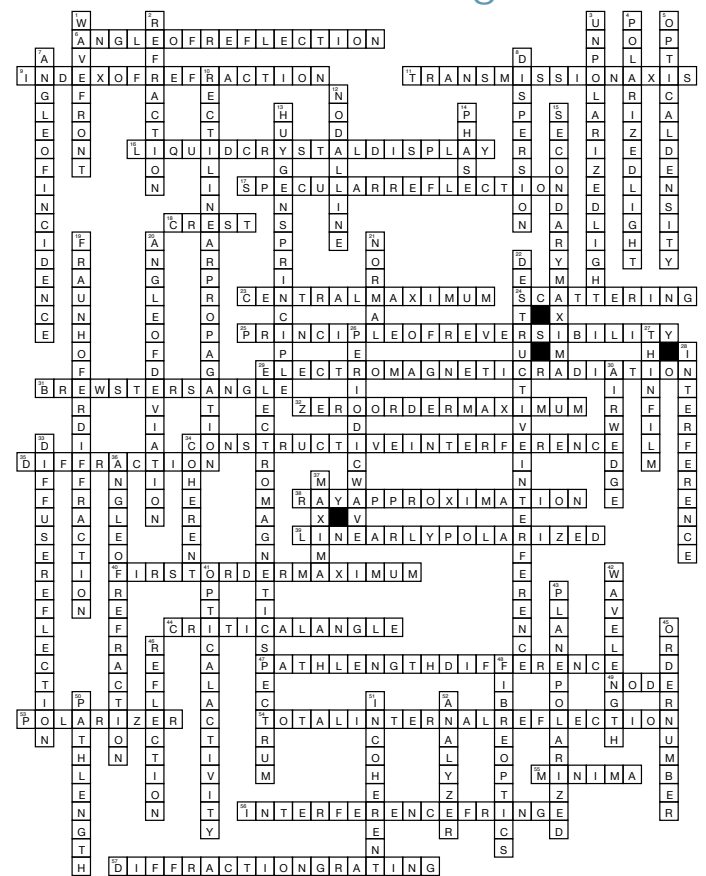
E	L	P	I	C	N	I	R	P	N	O	I	T	I	S	O	P	R	E	P	U	S	L	F	
L	Z	N	A	V	A	N	T	S	Z	Z	T	R	J	V	I	U	J	V	R	V	R	F	U	
E	M	E	I	Z	B	M	N	K	C	T	Z	Z	M	F	Q	C	M	O	C	R	P	J	N	
C	D	C	D	C	D	Q	S	J	O	P	N	W	N	E	I	K	O	E	C	U	I	I	J	
T	K	W	K	T	E	R	J	Q	C O U L O M B S L A W					F	T	A	F	A	J	D				
R	E	M	N	V	R	I	Z	X	H	C	K	P	O	V	K	X	C	E	F	G	M	B		
I	T	E	G	V	I	L	H	N	J	X	H	E	U	S	P	Q	N	Y	S	V	J	E		
C	P	H	G	L	W	W	C	P	E C R O F C I R T C E L E					E	I	N								
P	X	Z	R	P	O	K	E	P	H	S	K	T	G	Z	S	P	W	N	Q	Y	Z	I	T	
O	M	S	A	H	C	P	F	K	O	P	I N S U L A T O R					B	A	Z	A					
T	M	H	M	F	M	I	O	K	T	E	Z	O	H	B	H	X	H	J	Q	P	J	L		
E	W	H	C	C	X	T	K	D	M	F	E	N	I	T	Y	C	F	H	W	H	J	L	P	
N	W	C	Y	F	A	V	A	P	C	E	E	N	K	A	I	D	Q	I	T	P	C	U	H	
T	A	T	A	R	A	R	S	K	Z	I	U	C	T	L	B	W	T	F	M	R	Q	L	Y	
I	B	M	A	Z	S	E	C	L	R	I	R	A	I	U	D	A	X	T	U	S	E	S		
A	T	B	T	A	C	U	N	I	X	X	I	T	L	E	A	I	G	U	U	A	I	Y	I	
L	W	F	N	W	D	T	S	P	H	D	I	V	C	B	T	L	Q	B	F	W	Q	K	C	
D	R	U	E	D L E I F C I R T C E L E					E	C	W	H	V	K	A									
I	U	O	M	E	E	K	D	C	C	X	O	H	U	L	C	N	N	J	H	Q	W	L		
F	V	I	E	O	Y	R	A	W	P	D	G	R	J	A	O	E	S	S	E	K	Y	R	C	
F	I	U	L	S	Y	C	Z	B	S	F	E	N	N	H	K	N	Q	K	Z	R	B	C	O	
E	F	V	E	K	U	O	P	P	O	Q	C	D	H	M	O	T	R	R	Z	X	G	K	N	
R	K	I	F	Z	J	W	R	Z	H	Z	N	A	U	L	G	T	K	O	M	J	P	Y	S	
E	J	A	P	I	A	O	Y	I	K	U	C	W	P	U	N	C	Q	N	A	G	W	E	T	
N	S	R	A	X	O	Y	G	P	A	E	O	Y	X	A	C	O	C	K	O	S	S	Z	A	
C	I	D	K	V	T	J	S	O	F	A	C	T	O	R O T C U D N O C					N					
E	E	G	B	L	B	A	M	Y	X	M	D	M	F	W	Y	C	L	S	K	W	E	Q	T	
K	S	F	Q	V	D	S	P	N	A	D	I	X	J	U	A	X	Q	J	C	J	E	F	U	H
V	B	C	H	Y	S	D	F	T	Q	B	N	A	C	I	R	A	Y	A	Q	E	O	E	P	Z
S E N I L D L E I F C I R T C E L E					H G L V Y N																			

H	I	V	O	H	L	Q	Z	V	H	F	E	O	X	K	U	J	B	K	M	E	F	L	E	S	S	Q	X	V	Y	I	J		
P	O	X	Z	A	H	L	G	M	A	J	U	R	C	K	E	C	R	O	P	C	D	F	L	O	X	L	K	T	K	D	A	R	
C	I	B	X	A	P	L	G	M	A	J	U	R	C	K	E	C	R	O	P	C	D	F	L	O	X	L	K	T	K	D	A	R	
U	O	R	J	E	D	I	G	R	G	A	D	O	E	J	O	Q	Y	S	Y	G	K	F	R	X	A	R	E	V	Y	I	J	I	
M	O	R	J	E	D	I	G	R	G	A	D	O	E	J	O	Q	Y	S	Y	G	K	F	R	X	A	R	E	V	Y	I	J	I	
R	O	R	J	E	D	I	G	R	G	A	D	O	E	J	O	Q	Y	S	Y	G	K	F	R	X	A	R	E	V	Y	I	J	I	
M	B	E	U	A	S	G	Y	Q	R	C	K	E	C	R	O	P	C	D	F	L	O	X	L	K	T	K	D	A	R	E	V	Y	
E	G	H	L	E	U	A	S	G	Y	Q	R	C	K	E	C	R	O	P	C	D	F	L	O	X	L	K	T	K	D	A	R	E	
L	N	T	H	I	V	A	F	I	A	S	O	T	Q	O	J	U	T	S	L	O	L	X	I	Q	C	O	U	I	Z	R	E	C	
C	T	A	E	P	R	A	G	N	E	C	T	L	E	X	S	F	C	A	N	S	J	F	K	Y	Q	P	J	Z	M	R	O	R	
T	R	M	I	F	H	Z	A	E	L	R	C	O	N	T	Z	O	V	O	T	T	A	S	S	H	S	W	A	T	E	C	N	E	
I	C	E	C	L	P	T	U	L	E	V	E	N	M	O	A	Y	G	I	G	L	I	G	D	T	G	U	M	K	J	T	D	J	E
P	O	N	N	O	Q	B	D	L	E	I	F	L	A	N	O	I	T	A	T	I	V	A	R	G	J	I	T	R	Z	E	P	A	R
T	A	F	G	H	O	R	G	L	K	V	G	D	C	L	T	Y	A	C	I	F	K	P	W	E	T	H	L	I	G	T	R	E	
E	N	O	I	T	A	C	I	F	I	T	N	E	D	I	Y	C	N	E	U	O	E	R	F	O	D	A	R	K	P	I	C	K	
S	V	E	G	P	M	Z	W	X	Z	V	A	L	S	(S	P	A	C	E	S	T	A	T	I	O	N	R	G	S	X	F	I	S	
I	E	W	T	N	I	B	E	W	R	X	Z	V	A	L	S	X	Y	H	K	C	N	B	R	I	T	X	Z	S	U	S	E	F	
A	R	V	A	S	H	J	O	N	J	A	O	S	Q	G	O	I	A	N	R	S	M	Y	I	T	X	R	K	I	T	R	O	E	
L	E	T	L	H	P	E	P	J	Y	S	O	J	K	Q	D	P	O	A	H	Q	D	K	N	S	H	C	G	D	I	E	G	E	
N	T	L	S	B	N	A	P	J	Y	S	O	J	K	Q	D	P	O	A	H	Q	D	K	N	S	H	C	G	D	I	E	G	E	
E	E	L	M	G	J	Z	L	G	Z	J	N	H	L	W	J	B	V	K	A	Y	Q	A	N	O	I	V	N	C	U	N	C	Q	
R	N	A	A	O	A	N	Z	C	N	L	H	T	L	(E	L	E	C	T	R	I	C	F	I	E	L	D	I	N	V	M	C	P	R
G	G	A	H	I	T	M	U	K	S	C	L	N	J	J	J	O	V	C	E	I	H	A	E	O	K	N	Q	J	J	P	E	A	
A	W	L	F	L	T	G	C	H	O	M	Q	Y	U	D	O	I	Z	L	T														

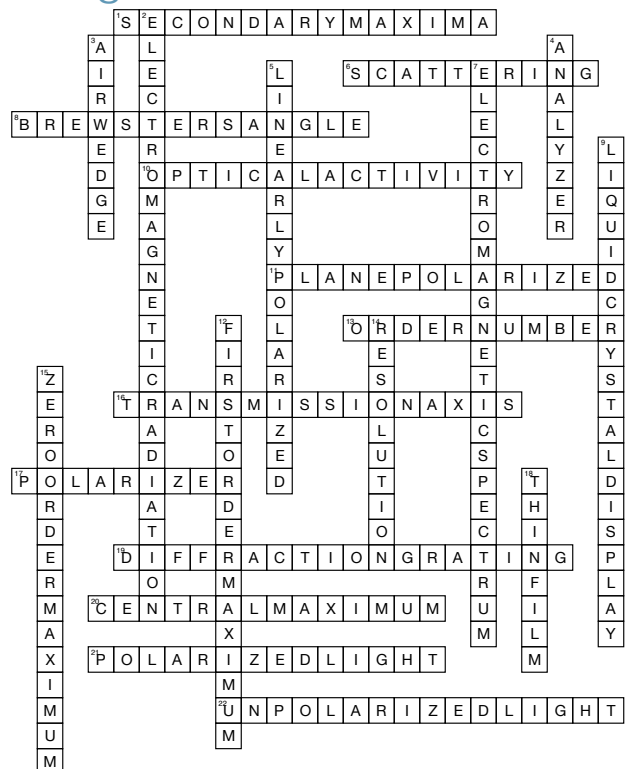
Waves and Light



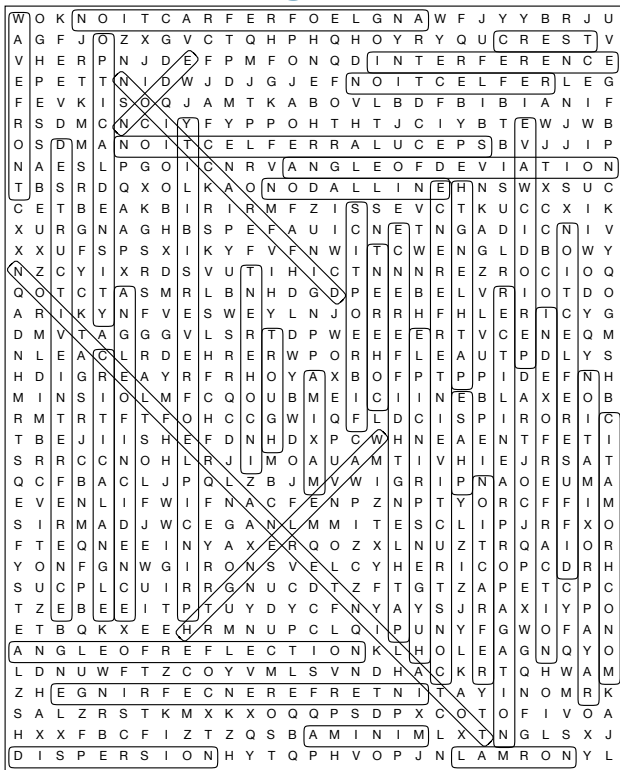
The Wave Nature of Light



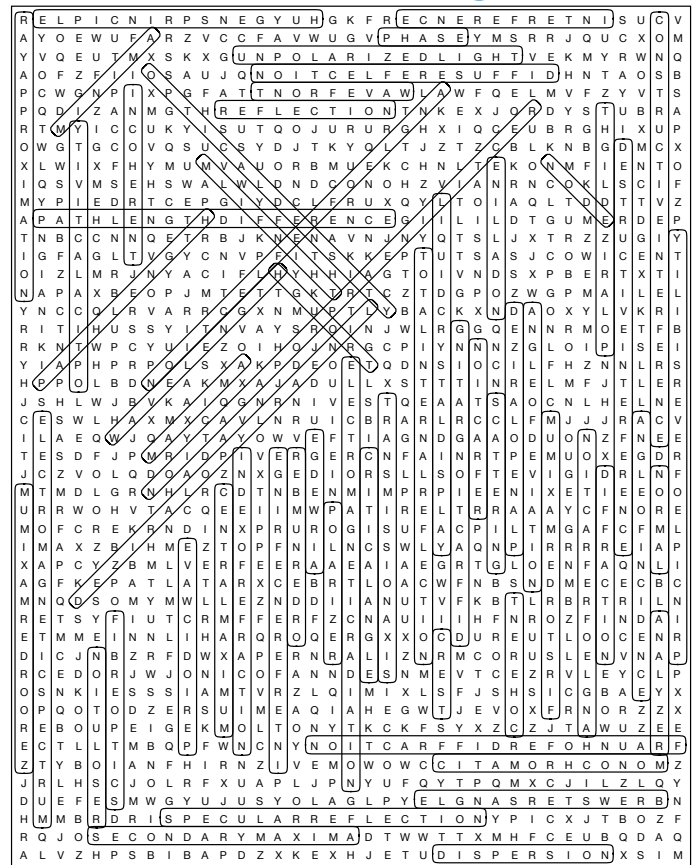
Applications of the Wave Nature of Light



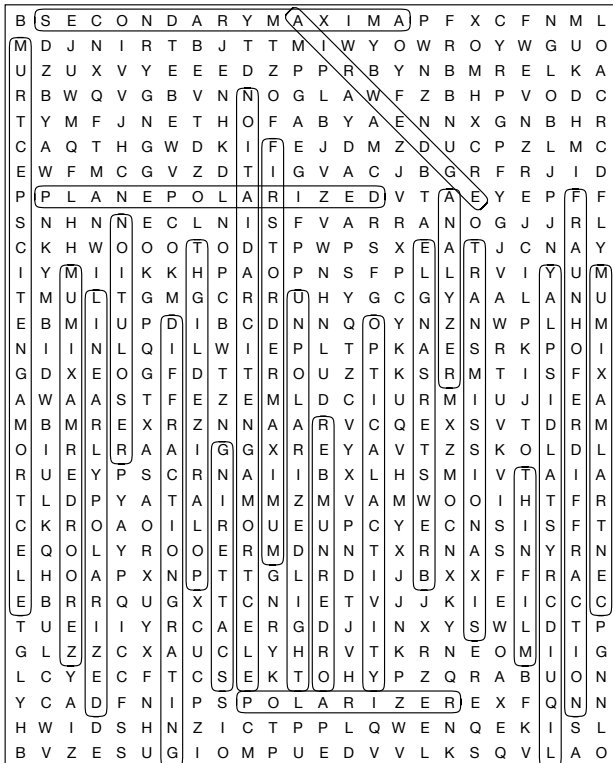
Waves and Light



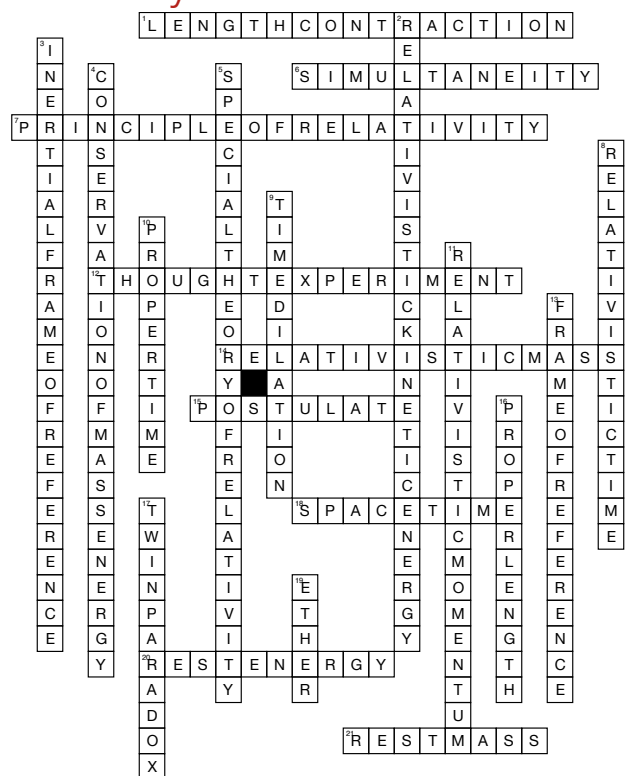
The Wave Nature of Light



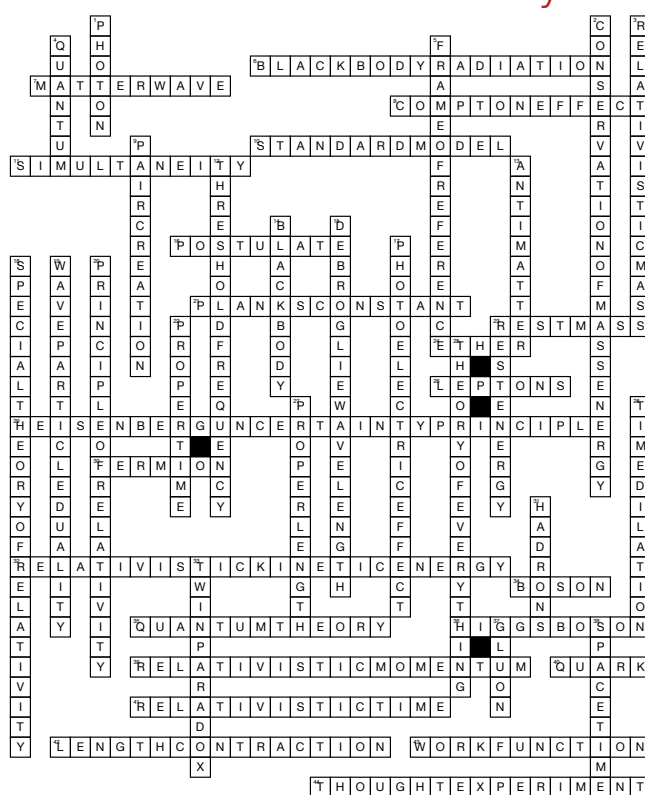
Applications of the Wave Nature of Light



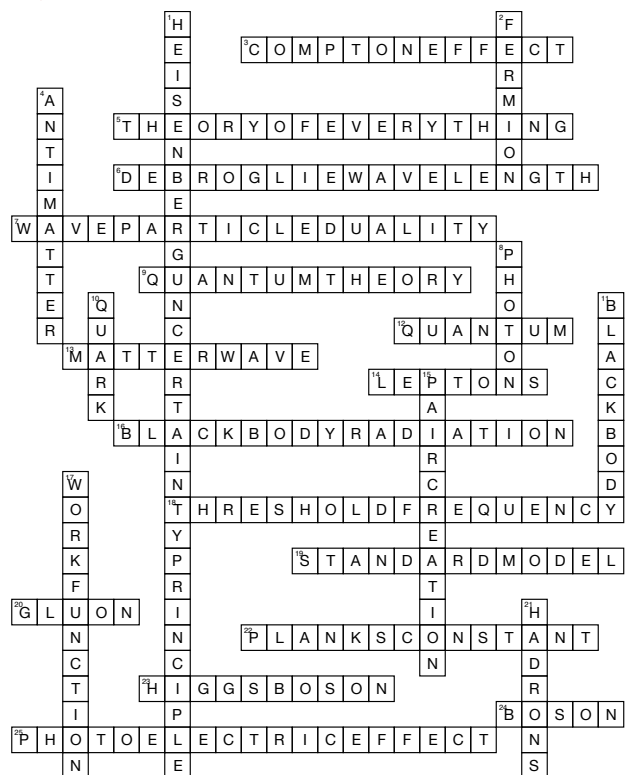
Relativity



Revolutions in Modern Physics



Quantum Mechanics



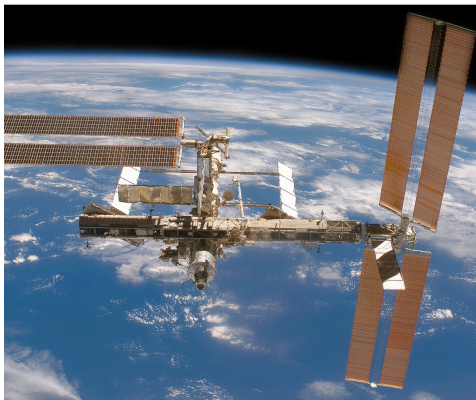
R	I	J	K	P	J	N	K	U	F	E	R	Q	D	W	Y	C	Q	A	F	U	B	O	E	G
I	R	T	B	F	J	Y	M	N	R	S	E	Z	J	G	R	B	B	A	F	Q	X	S	X	W
T	M	L	L	B	S	O	R	G	A	P	L	F	B	Q	P	W	R	O	Y	H	H	Z	C	M
D	S	O	F	G	Y	U	G	M	E	T	A	C	C	E	R	S	P	N	Z	R	K	C	N	H
Z	T	F	Y	G	U	K	T	O	E	C	T	Z	X	Y	L	X	L	L	A	S	G	V	J	Y
X	N	K	R	Y	T	H	J	O	I	I	T	T	I	M	E	D	I	L	A	T	I	O	N	E
G	E	L	E	G	N	Y	B	F	A	V	V	S	P	A	C	E	T	I	M	E	I	N	Y	
K	M	E	N	E	R	J	P	R	L	I	I	U	D	J	D	E	N	V	W	Y	Q	N	T	
O	I	R	G	S	E	R	M	G	E	T	S	F	B	N	N	U	N	Y	C	Q	T	R	X	I
I	R	G	S	E	N	T	E	R	M	F	T	S	H	Y	F	U	C	C	E	I	L	I	V	
X	E	T	S	E	I	R	W	F	E	I	Q	U	J	T	D	I	G	V	H	E	Z	P	I	
O	P	H	A	C	A	S	P	R	O	M	C	J	W	S	G	P	G	K	N	J	N	E	R	T
D	X	C	M	I	F	S	E	M	N	C	M	Z	M	K	X	G	O	W	H	P	A	J	O	A
A	E	O	F	T	A	M	I	C	O	M	O	M	R	A	Z	H	C	X	R	C	T	Q	P	L
E	R	T	N	O	E	R	M	I	C	O	M	I	R	J	R	Q	Z	O	E	K	L	E	E	R
A	H	T	N	O	N	A	M	I	C	O	M	E	E	G	M	F	P	P	S	U	E	R	R	F
P	G	R	O	I	M	T	C	F	R	N	H	B	U	B	V	E	L	F	T	O	M	I	R	L
N	I	O	A	I	K	E	T	Z	E	U	Z	U	G	R	S	P	D	E	J	S	I	H	E	O
U	C	A	I	C	O	S	T	Q	L	G	A	M	L	I	D	J	R	W	Z	E	Q	Y	L	G
I	W	H	T	I	V	T	R	V	I	D	T	X	M	W	P	X	Y	H	N	R	E	T	F	T
C	E	O	R	S	E	I	V	I	W	I	E	M	G	D	E	U	H	E	U	G	B	G	F	H
Q	T	N	E	I	F	T	X	V	A	Q	A	X	H	T	E	U	Y	N	M	E	K	F	I	
Q	A	Q	S	V	E	A	T	R	I	U	A	M	X	S	P	S	H	W	L	J	Z	D	C	N
Y	L	H	N	I	R	L	A	C	T	Y	E	N	F	M	Y	P	P	F	R	S	D	L	J	R
H	U	D	O	T	E	R	E	D	Y	E	N	F	M	Y	P	P	F	R	S	D	L	J	R	
G	T	K	C	A	N	I	R	E	W	D	Z	H	A	X	C	Q	S	A	U	G	P	V	Z	P
U	S	F	B	L	E	I	R	N	Y	R	S	C	S	V	Y	A	S	T	U	L	Y	U	M	
Q	O	R	C	E	E	M	A	S	O	M	N	H	E	O	T	V	O	L	G	R	U	R	B	
T	P	V	Y	E	E	D	F	S	Y	W	R	J	S	V	A	T	I	E	B	S	A	N		

R	Z	N	D	J	V	H	K	A	H	C	B	I	W	U	H	T	G	N	E	L	R	E	P	O	R	P	C	T	T	U	A		
L	E	R	V	M	U	T	A	V	E	S	A	U	Q	J	G	V	O	W	V	D	I	M	V	B	R	R	R	R	C	G	V	Y	
S	G	L	N	X	T	A	V	E	S	G	O	L	C	K	G	M	P	L	F	H	E	U	O	C	Z	E	T	P	A	R			
F	N	O	I	T	A	I	D	A	R	Y	D	O	B	K	C	A	L	B	X	F	H	P	Z	K	M	U	V	C	H	I	W	R	
T	S	V	X	Y	L	G	E	B	R	I	L	Q	L	S	S	A	M	C	I	S	I	V	I	T	A	L	E	R	I				
H	E	P	U	C	Z	R	H	N	L	O	W	E	J	J	R	E	S	T	E	N	E	R	G	E	R	G	Y	U	C	I			
H	O	E	K	N	V	B	T	I	A	V	S	P	R	N	X	W	Z	B	U	F	J	D	H	O	S	I	F	E	O	G	N		
G	U	N	H	T	E	D	L	K	R	T	K	J	U	T	C	R	N	I	D	O	A	X	O	E	Y	O	E	I					
H	Z	H	E	C	U	N	H	T	C	S	O	N	L	E	C	Y	O	S	J	Q	S	O	F	O	B	R	A	N	G	W	O		
H	Z	B	R	E	O	R	E	M	S	O	E	V	W	T	U	G	N	O	N	W	T	Z	C	Z	M	B	R	A	P	I			
T	E	V	E	O	E	M	S	O	O	P	O	J	W	B	M	I	Y	M	S	T	L	X	L	E	E	V	N	O	X	T			
E	X	O	F	P	F	O	A	N	S	A	N	G	T	E	N	A	H	L	L	O	J	O	V	W	E	R	N	E	O	T	G		
X	P	K	E	R	A	D	V	M	S	C	O	G	P	C	Z	Y	S	G	Y	O	U	C	A	O	N	W	B	X	K	E			
E	R	R	E	A	C	L	F	T	U	H	R	X	A	B	S	W	Q	T	M	N	R	B	T	J	R	Y	S	L	T				
E	R	I	F	E	O	E	S	L	X	H	Y	R	B	Q	K	W	D	C	T	T	S	W	C	O	N	P	T	D	E				
I	M	E	E	I	O	T	S	I	R	E	W	N	Q	R	A	O	P	X	R	E	E	I	G	O	U	G	E	H	Q	R			
E	N	D	A	E	M	E	I	J	I	U	I	D	O	Y	D	T	I	L	I	A	E	L	I	H	O	P	B	L	O				
T	I	R	E	R	B	X	W	B	D	A	X	A	K	E	H	R	E	E	A	L	O	D	P	S	X								
T	H	L	F	I	R	H	W	B	K	T	Y	K	A	I	C	D	J	K	Y	W	N	L	L	Y	R	L	K	P	A				
H	S	A	L	I	U	T	L	M	E	A	J	T	N	I	U	M	Z	A	G	T	F	X	N	V	T	U	X	F	X				
S	U	T	A	I	U	B	A	X	S	T	I	A	F	Z	T	H	E	T	X	K	N	O	T	O	H	P	L	E					
D	I	I	A	U	V	G	S	K	M	S	L	E	M	K	E	H	B	S	E	S	U	N	B	K	G	O	R	B					
S	O	T	X	J	N	D	R	V	T	M	T	H	E	O	R	Y	O	F	E	V	E	R	Y	T	H	I	N	G					
L	N	R	H	B	I	L	I	V	I	P	U	N	N	Y	V	M	S	C	O	E	I	J	K	O	E	F	N	U					
F	T	E	Z	N	N	T	O	G	V	G																							

R	T	N	U	C	D	T	Z	H	P	C	H	Z	H	N	E	B	C	N	B	T	Y	U	B
D	Q	I	T	Q	O	U	Y	E	P	C	F	W	Y	O	G	X	J	N	L	X	R	Y	X
F	E	T	B	Q	K	X	E	I	Z	R	M	N	U	P	C	L	B	S	A	G	O	Y	P
Y	W	F	F	F	F	P	N	B	S	B	S	L	H	C	Y	E	B	O	O	C	M	E	T
A	G	U	L	D	H	O	G	E	N	T	L	Q	N	C	W	F	S	O	B	K	O	H	V
L	S	V	N	D	H	I	K	N	A	L	Q	H	W	N	C	Z	O	S	B	S	T	P	T
Q	A	W	M	U	M	M	T	B	W	U	O	K	A	E	Z	N	N	G	O	K	M	A	I
Z	R	S	T	K	M	R	K	E	O	Q	Q	P	S	U	V	X	C	G	D	L	U	L	M
O	A	H	X	X	F	E	C	R	I	Z	T	Z	Q	Q	B	A	G	H	I	T	T	E	A
B	G	G	L	S	X	F	F	P	G	S	Z	N	E	B	E	G	W	H	I	T	Q	N	D
O	N	L	N	I	P	O	Q	U	A	N	T	U	M	R	H	I	I	R	E	T	A	O	T
F	O	G	U	W	K	I	U	N	B	Z	D	Z	L	F	N	I	L	A	E	G	U	M	E
A	T	U	V	O	A	T	I	C	W	S	L	J	G	D	Q	T	A	V	W	T	Q	D	R
P	H	T	X	G	N	E	L	E	V	A	W	E	I	L	G	O	R	B	E	D	T	R	Y
A	H	Z	P	U	X	I	R	P	P	Z	U	J	O	B	S	U	T	I	P	C	A	S	
I	P	L	U	N	T	K	T	X	J	Y	C	P	H	U	T	Q	J	D	I	N	D	M	
R	W	Y	F	Q	N	P	Z	A	C	L	I	B	T	S	F	Z	P	U	D	L	U	N	X
C	W	C	T	C	Q	D	H	I	Y	A	X	O	N	E	V	K	M	W	A	B	O	A	K
E	R	F	M	D	N	F	M	N	R	I	S	R	R	P	V	B	I	D	R	Z	T	H	
R	O	K	W	S	S	N	O	T	P	E	L	N	A	H	Y	Q	M	D	O	H	K	S	M
A	K	G	O	O	R	B	O	Y	F	B	T	H	U	T	F	H	A	D	R	O	N	S	H
T	F	K	R	D	J	U	V	P	N	D	N	B	A	K	M	H	O	D	X	P	W	C	U
I	U	E	B	T	H	E	O	R	Y	O	F	F	E	V	E	R	Y	T	H	I	N	G	R
O	N	V	D	Q	H	D	I	U	U	C	E	G	A	P	Y	Z	X	L	N	X	H	C	
N	C	G	C	F	N	T	W	N	P	L	A	N	K	S	C	O	N	S	T	A	N	T	X
G	T	T	C	E	F	F	E	C	I	R	T	C	E	L	E	O	T	O	H	P	V	S	R
V	I	L	I	M	M	N	O	I	T	A	I	D	A	R	Y	D	O	B	K	C	A	L	B
E	O	C	W	W	A	V	E	P	A	R	T	I	C	L	E	D	U	A	L	I	T	Y	O
T	N	F	V	U	X	G	L	G	U	T	C	E	F	F	E	N	O	T	P	M	O	C	
C	B	N	B	X	P	M	E	E	J	U	W	E	X	H	T	V	W	G	L	G	K	L	E

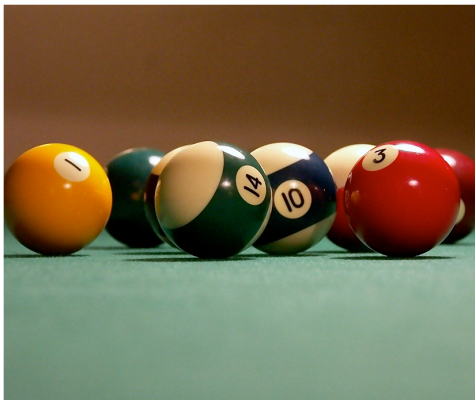
Word Puzzles

from *Nelson Physics 12*



Dynamics

Contains puzzles for *Kinematics*, *Dynamics*, *Uniform Circular Motion*, and the whole unit.



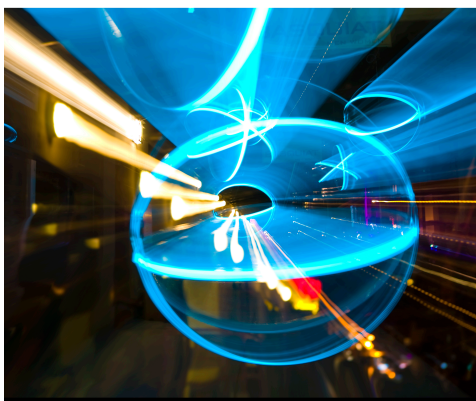
Energy and Momentum

Contains puzzles for *Work and Energy*, *Momentum and Collisions*, and the whole unit.



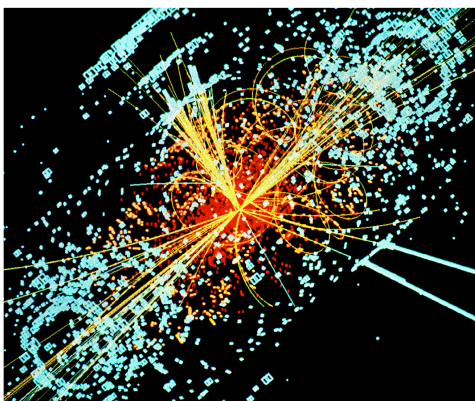
Gravitational, Electric, & Magnetic

Fields: Contains puzzles for *Gravitational Fields*, *Electric Fields*, *Magnetic Fields*, and the whole unit.



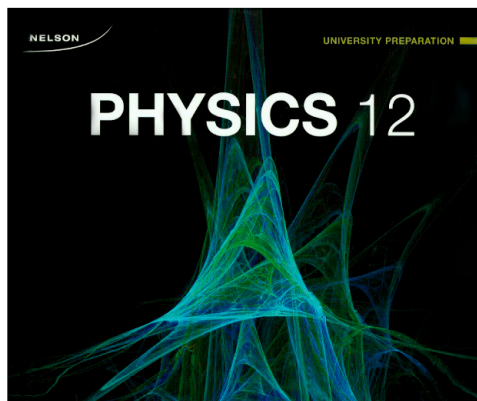
The Wave Nature of Light

Contains puzzles for *Waves and Light*, *Applications of the Wave Nature of Light*, and the whole unit.



Revolutions in Modern Physics

Contains puzzles for *Relativity*, *Quantum Mechanics*, and the whole unit.



Nelson Education

1120 Birchmount Road
Scarborough, Ontario
M1K 5G4

Science is the great antidote to the poison of enthusiasm and superstition.

Adam Smith