

- (f) decreases rate of reaction
- (g) increases rate of reaction
- (h) decreases rate of reaction
- (i) increases rate of reaction
- (j) increases rate of reaction

2.

	Situation X	Situation Y	Situation with a higher reaction rate (X or Y)	Factor affecting the rate of reaction
(a)	1 g of sugar (cubes)	1 gram of sugar (grains)	Y	surface area
(b)	50°C	0°C	X	temperature
(c)	low number of particles = few collisions	high number of particles = more collisions	Y	concentration
(d)	enzyme added	no enzyme added	X	catalyst
(e)	twigs	logs	X	surface area

Applying Knowledge

Four factors affecting the rate of reactions

Page 118

1. (a) line Y
(b) line X
(c) line Y
(d) line X
(e) line Y
(f) line X
(g) line Y
(h) line X
2. (a) surface area
(b) catalyst
(c) temperature
(d) concentration

Assessment

Factors affecting the rate of chemical reactions

Page 119

1. D 2. C 3. A 4. B 5. E 6. F 7. D 8. B 9. D 10. B

Chapter 7 The atomic theory explains radioactivity.

Section 7.1 Atomic Theory Isotopes, and Radioactive Decay

Applying Knowledge

Isotopes

Page 123

1. different atoms of a particular element that have the same number of protons but different numbers of neutrons
2. mass number
3. mass number
4. number of neutrons
5. "13" represents the mass number; "5" represents the atomic number
6. boron-13 or B-13
7. (a) 5
(b) 5
(c) 8
8. (a) neon with 11 neutrons
(b) sulphur with 16 neutrons
(c) actinium with 141 neutrons
(d) thorium with 144 neutrons
- 9.

Isotope	Standard atomic notation	Atomic number	Mass number	Number of protons	Number of neutrons
carbon-14	$^{14}_6\text{C}$	6	14	6	8
cobalt-52	$^{52}_{27}\text{Co}$	27	52	27	25
nickel-60	$^{60}_{28}\text{Ni}$	28	60	28	32
nitrogen-14	$^{14}_7\text{N}$	7	14	7	7
thallium-201	$^{201}_{81}\text{Tl}$	81	201	81	120
radium-226	$^{226}_{88}\text{Ra}$	88	226	88	138
lead-208	$^{208}_{82}\text{Pb}$	82	208	82	126

Comprehension

Alpha, beta, and gamma radiation

Page 125

1. diagram labelling: alpha particle (on the first line); beta particle (on the second line); gamma ray (on the third line)
2. (a) gamma ray
(b) beta particle
(c) alpha particle
(d) gamma ray

- (e) beta particle
- (f) alpha particle
- (g) alpha particle
- (h) beta particle
- (i) alpha particle, beta particle, and gamma ray
- (j) beta particle
- (k) alpha particle
- (l) beta particle
- (m) gamma ray
- (n) alpha particle and beta particle
- (o) gamma ray
- (p) gamma ray
- (q) gamma ray
- (r) alpha particle
- (s) gamma ray

Applying Knowledge

Radioactive decay and nuclear equations

Page 126

1. ${}_{15}^{32}\text{P} \rightarrow \text{S} + {}_{-1}^{0}\text{e}$ or ${}_{-1}^{0}\beta$ BETA DECAY
2. ${}_{84}^{218}\text{Po} \rightarrow \text{Pb} + {}_{2}^{4}\text{He}$ ALPHA DECAY
3. ${}_{17}^{35}\text{Cl} \rightarrow \text{Ar} + {}_{-1}^{0}\text{e}$ BETA DECAY
4. ${}_{12}^{24}\text{Mg}^* \rightarrow \text{Mg} + {}_{12}^{0}\gamma$ GAMMA DECAY
5. ${}_{91}^{234}\text{Pa} \rightarrow \text{Ac} + {}_{2}^{4}\text{He}$ ALPHA DECAY
6. ${}_{58}^{141}\text{Ce} \rightarrow \text{Pr} + {}_{-1}^{0}\text{e}$ BETA DECAY
7. ${}_{84}^{216}\text{Po} \rightarrow \text{At} + {}_{-1}^{0}\beta$ BETA DECAY
8. ${}_{9}^{20}\text{F} \rightarrow \text{Ne} + {}_{-1}^{0}\text{e}$ or ${}_{-1}^{0}\beta$ BETA DECAY
9. ${}_{26}^{58}\text{Fe}^* \rightarrow \text{Fe} + {}_{0}^{0}\gamma$ GAMMA DECAY
10. ${}_{89}^{225}\text{Ac} \rightarrow \text{Fr} + {}_{2}^{4}\text{He}$ ALPHA DECAY
11. ${}_{64}^{149}\text{Gd}^* \rightarrow \text{Gd} + {}_{0}^{0}\gamma$ GAMMA DECAY
12. ${}_{88}^{226}\text{Ra} \rightarrow \text{Rn} + {}_{2}^{4}\text{He}$ ALPHA DECAY
13. ${}_{81}^{212}\text{Tl} \rightarrow \text{Pb} + {}_{-1}^{0}\beta$ BETA DECAY
14. ${}_{83}^{214}\text{Bi} \rightarrow \text{Tl} + {}_{2}^{4}\text{He}$ ALPHA DECAY
15. ${}_{98}^{254}\text{Cf}^* \rightarrow \text{Cf} + {}_{0}^{0}\gamma$ GAMMA DECAY

Assessment

Atomic theory, isotopes, and radioactive decay Page 127

1. D 2. A 3. C 4. C 5. B 6. B 7. C 8. A 9. A 10. A 11. A
12. C 13. C 14. D 15. A 16. C

Section 7.2 Half-Life

Applying Knowledge

Radioactive decay

Page 132

1. (a) the time required for half the nuclei in a sample of a radioactive isotope to decay; a constant for any radioactive isotope
- (b) a curved line on a graph that shows the rate at which radioisotopes decay
- (c) the isotope that undergoes radioactive decay
- (d) the stable product of radioactive decay

2.

Half-life	Percent of parent isotope	Percent of daughter isotope
0	100	0
1	50	50
2	25	75
3	12.5	87.5
4	6.25	93.75

Half-life	Fraction of parent isotope	Fraction of daughter isotope
0	1	0
1	$\frac{1}{2}$	$\frac{1}{2}$
2	$\frac{1}{4}$	$\frac{3}{4}$
3	$\frac{1}{8}$	$\frac{7}{8}$
4	$\frac{1}{16}$	$\frac{15}{16}$

3. (a)

Half-life	Time (a)	Mass (g)
0	0	120
1	5	60
2	10	30
3	15	15
4	20	7.5
5	25	3.75

- (b) 3.75 g
- (c) 3 half-lives
- (d) 20 years
- (e) The graph should show a decay curve.

4. (a)

Half-life	Time (a)	Mass of parent isotope (g)	Mass of daughter isotope (g)
0	0	80	0
1	20	40	40
2	40	20	60
3	60	10	70
4	80	5	75
5	100	2.5	77.5

- (b) 5 g
 (c) 2.5 g
 (d) 70 g
 (e) 100 years
 (f) 1:3

Comprehension

Calculating half-life

Page 134

1. (a) $\frac{1}{8}$
 (b) 6.25%
 (c) $\frac{3}{4}$
 (d) 96.875%
2. 18 g
 3. 12.5%
 4. 48 g
 5. 1420 million years old
 6. 3.9 billion years old
 7. 9 billion years
 8. 5 years
 9. 10 g

Analyzing Information

Decay curves

Page 135

1. (a) 2 days
 (b) 20 g
 (c) 70 g
 (d) $\frac{1}{16}$
 (e) 8 days
2. (a) potassium-40 and argon-40
 (b) 1.3 billion years
 (c) equal amounts of daughter and parent isotopes
 (d) $\frac{15}{16}$
 (e) 1:3

Assessment

Half-life

Page 136

1. D 2. C 3. B 4. A 5. C 6. A 7. C 8. D 9. B 10. C 11. B
 12. C

Section 7.3 Nuclear Reactions

Cloze Activity

Radioactivity

Page 140

- nuclear fission
- unstable
- energy
- nuclear reaction; isotope
- subatomic particles
- induced
- proton
- neutron
- chain reaction
- CANDU reactor
- nuclear fusion; Sun

Comprehension

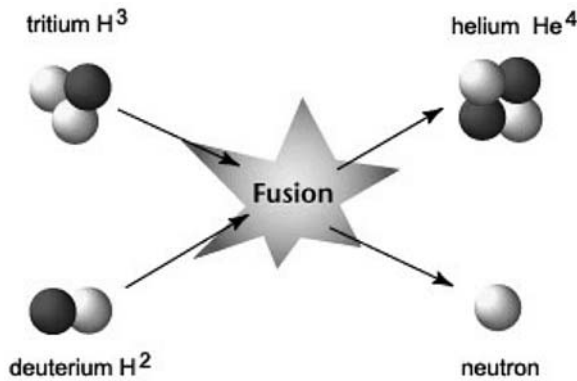
Comparing nuclear fission and fusion

Page 141

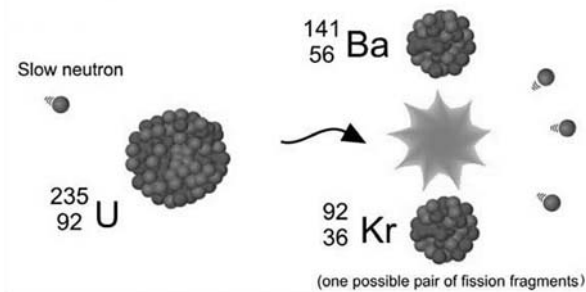
1.

	Nuclear fission	Nuclear fusion
Give a description of the process.	one heavy unstable nucleus splits up into lighter nuclei	two small nuclei combine to form one large nucleus
What is produced as a result of this nuclear process?	huge amounts of energy; neutrons; radioactive isotopes	huge amounts of energy; neutron(s)
Are the products radioactive?	products are often radioactive	products are not often radioactive
What is needed for this nuclear reaction to occur?	a neutron	high temperature and sufficient pressure
Where does this process occur?	induced fission in nuclear fission reactors; atom bombs	Sun; stars; hydrogen bombs
Give an example of a nuclear equation.	answers may vary ${}_0^1n + {}_{92}^{235}\text{U} \rightarrow {}_{36}^{92}\text{Kr} +$ ${}_{56}^{141}\text{Ba} + 3{}_0^1n + \text{energy}$	answers may vary ${}_1^2\text{H} + {}_1^3\text{H} \rightarrow {}_2^4\text{He} +$ ${}_0^1n + \text{energy}$

2. (a) nuclear fusion



(b) nuclear fission



Applying Knowledge

Nuclear fission and fusion reactions

Page 142

- $3\ ^1_0n$, Fission $^{239}_{94}Pu$
- $2\ ^2_1H$, Fusion
- $^{80}_{32}Ge$, Fission
- 1_0n , Fusion
- $^{235}_{92}U$, Fission
- 1_0n , Fusion
- $^{113}_{46}Pd$, Fission
- $^{127}_{53}I$, Fission
- $3\ ^1_0n$, Fission
- $^{239}_{94}Pu$, Fission

Assessment

Nuclear reactions

Page 143

- B
- C
- B
- F
- A
- E
- D
- B
- C
- D
- C
- C
- B

UNIT 3 Motion

Chapter 8 Average velocity is the rate of change in position.

Section 8.1 The Language of Motion

Comprehension

Scalars versus vectors

Page 147

- (a) scalar: a quantity that has a magnitude but not a direction

(b) vector: a quantity that has both a magnitude and a direction

(c) magnitude: the size of a measurement or an amount

(d) reference point: the point from which the change is measured

2.

Quantity	Symbol	SI Unit	Scalar or Vector
time	t	s (seconds)	scalar
time interval	Δt	s (seconds)	scalar
distance	d	m (metres)	scalar
position	\vec{d}	m (metres)	vector
displacement	$\Delta\vec{d}$	m (metres)	vector

3. (a) V (b) S (c) S (d) V

- (a) positive (+)

(b) negative (-)

(c) positive (+)

(d) negative (-)

Applying Knowledge

Distance, position, and displacement

Page 148

1.

t_i (s)	t_f (s)	Δt (s)	d_i (m)	d_f (m)	Δd (m)	Direction of Motion
6.0	7.5	1.5	+18.4	+22.6	+4.2	right
5.7	8.5	2.8	+24.3	+30.1	+5.8	up
20.2	38.4	18.2	+39.1	+24.8	-14.3	south
12.4	18.8	6.4	+54.8	+46.2	-8.6	west

2. (a) 12 m

(b) 0 m

3. (a)

Time	Position
0 min	0 m
1 min	180 m [E]
2 min	40 m [E]
3 min	140 m [E]