Chapter 4

Stoichiometry

4.1 Stoichiometry

01. 0620_m21_qp_22 Q: 10

A compound has the formula XF_2 and has a relative mass of 70.

What is element X?

A gallium

B germanium

C sulfur

D ytterbium

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02. 0620_s21_qp_21 Q: 9

2.56 g of a metal oxide, MO_2, is reduced to 1.92 g of the metal, M.

What is the relative atomic mass of M?

A 48 **B** 96 **C** 128 **D** 192

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03. 0620_s21_qp_22 Q: 9

Chlorine gas will react with iron metal.

Exactly 21.3 g of chlorine reacts with 11.2 g of iron.

How many iron atoms react with 30 molecules of chlorine?

A 10 **B** 15 **C** 20 **D** 30

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04. 0620_s21_qp_23 Q: 9

Three ionic compounds of vanadium have the formulae V_2O, VCl_2 and V_2O_3.

What is the charge on the vanadium ion in each compound?

	V_2O	VCl_2	V_2O_3
A	+1	–2	+2
B	+1	+2	+3
C	+2	–2	+2
D	+2	+2	+3

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05. 0620_s21_qp_23 Q: 11

The equation for the decomposition of calcium carbonate is shown.

$$CaCO_3 \rightarrow CaO + CO_2$$

What mass of calcium oxide is produced when 10 g of calcium carbonate is heated?

A 4.4 g **B** 5.0 g **C** 5.6 g **D** 10.0 g

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06. 0620_s21_qp_23 Q: 12

Gas syringe X contains 100 cm^3 of hydrogen bromide gas, HBr.

Gas syringe Y contains 100 cm^3 of carbon dioxide gas. The volume of each gas is measured at room temperature and pressure.

Which statement is correct?

A The mass of HBr is less than the mass of CO_2.

B The number of molecules of HBr equals the number of molecules of CO_2.

C The gas in syringe X contains more atoms than the gas in syringe Y.

D The number of moles of HBr is more than the number of moles of CO_2.

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07. 0620_s21_qp_23 Q: 37

How much hydrogen is needed to react completely with 0.02 moles of butene to make butane?

A 0.24 dm^3 **B** 0.48 dm^3 **C** 0.96 dm^3 **D** 1.20 dm^3

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08. 0620_w21_qp_21 Q: 6

The equation for the reaction of iron(III) oxide with carbon monoxide is shown.

$$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$$

What is the maximum mass of iron that can be made from 480 g of iron(III) oxide?

A 56 g **B** 112 g **C** 168 g **D** 336 g

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09. 0620_w21_qp_21 Q: 9

The formula of an aluminium ion is Al^{3+}.

What is the formula of aluminium sulfate?

A Al_2SO_4 **B** $Al(SO_4)_2$ **C** $Al_2(SO_4)_3$ **D** $Al_3(SO_4)_2$

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10. 0620_w21_qp_22 Q: 9

The equation for the reaction of sodium with water is shown.

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

What is the volume of hydrogen gas, measured at r.t.p., produced when 18.4 g of sodium reacts with excess water?

A 9.6 dm^3 **B** 15.0 dm^3 **C** 19.2 dm^3 **D** 30.0 dm^3

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11. 0620_w21_qp_23 Q: 13

What is the concentration of the solution when 31.8 g of sodium carbonate, Na_2CO_3, is dissolved in water to make a solution of 250 cm^3?

A 0.075 mol / dm^3

B 0.30 mol / dm^3

C 1.2 mol / dm^3

D 1.5 mol / dm^3

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12. 0620_m20_qp_22 Q: 8

The formulae of some ions are shown.

positive ions	negative ions
Al^{3+}	Cl^{-}
Fe^{2+}	N^{3-}
Mg^{2+}	NO_3^{-}
Na^{+}	O^{2-}
Zn^{2+}	SO_4^{2-}

In which row is the formula **not** correct?

	compound	formula
A	aluminium oxide	Al_2O_3
B	iron(II) nitride	Fe_2N_3
C	sodium sulfate	Na_2SO_4
D	zinc nitrate	$Zn(NO_3)_2$

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13. 0620_p20_qp_20 Q: 8

What is the relative molecular mass, M_r, of butanol?

A 15 **B** 37 **C** 74 **D** 148

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14. 0620_p20_qp_20 Q: 9

The chemical formulae of two substances, W and X, are given.

W $NaAlSi_3O_8$

X $CaAl_2Si_2O_8$

Which statements are correct?

1 W and X contain the same amount of oxygen.

2 W contains three times as much silicon as X.

3 X contains twice as much aluminium as W.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 1, 2 and 3

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15. 0620_s20_qp_21 Q: 8

A solution of iron(III) sulfate reacts with aqueous sodium hydroxide to form a red–brown precipitate.

What is the balanced equation, including state symbols, for the reaction?

A $FeSO_4(aq) + 2NaOH(aq) \rightarrow Fe(OH)_2(s) + Na_2SO_4(aq)$

B $FeSO_4(l) + 2NaOH(l) \rightarrow Fe(OH)_2(s) + Na_2SO_4(l)$

C $Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 2Fe(OH)_3(s) + 3Na_2SO_4(aq)$

D $Fe_2(SO_4)_3(l) + 6NaOH(aq) \rightarrow 2Fe(OH)_3(s) + 3Na_2SO_4(l)$

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16. 0620_s20_qp_22 Q: 8

Lead(II) nitrate, $Pb(NO_3)_2$, reacts with potassium iodide, KI, to form a yellow precipitate, PbI_2, and a soluble salt, KNO_3.

What is the equation for the reaction?

A $Pb(NO_3)_2 + KI \rightarrow PbI_2 + KNO_3$

B $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + KNO_3$

C $2Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$

D $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$

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17. 0620_s20_qp_23 Q: 8

Aluminium metal reacts with iron(III) oxide to form aluminium oxide and iron.

Which chemical equation for the reaction between aluminium and iron(III) oxide is correct?

A $FeO + Al \rightarrow AlO + Fe$

B $Fe_2O + 2Al \rightarrow Al_2O + 2Fe$

C $Fe_2O_3 + Al \rightarrow Al_2O_3 + Fe$

D $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

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18. 0620_w20_qp_21 Q: 11

Sodium carbonate reacts with sulfuric acid to form carbon dioxide, water and a sodium salt.

An incomplete equation for the reaction is shown.

$$Na_2CO_3 + H_2SO_4 \rightarrow CO_2 + H_2O + ...$$

What is the formula of the sodium salt?

A $Na_2(SO_4)_2$ **B** $Na(SO_4)_2$ **C** Na_2SO_4 **D** $NaSO_4$

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19. 0620_w20_qp_21 Q: 12

The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

A a neutron

B a proton

C an atom of carbon-12

D an atom of hydrogen-1

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20. 0620_w20_qp_21 Q: 13

What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

A FeO **B** Fe_2O **C** Fe_2O_3 **D** Fe_3O_4

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21. 0620_w20_qp_22 Q: 8

Ethyl methanoate, $HCOOC_2H_5$, burns in excess oxygen to produce carbon dioxide and water.

The equation is shown.

$$2HCOOC_2H_5 + xO_2 \rightarrow 6CO_2 + 6H_2O$$

What is the value of x?

A 2 **B** 7 **C** 9 **D** 18

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22. 0620_w20_qp_22 Q: 9

Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

	electron change	formula of ion formed
A	electron gained	Rb^+
B	electron gained	Rb^-
C	electron lost	Rb^+
D	electron lost	Rb^-

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23. 0620_w20_qp_22 Q: 11

The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

A a neutron

B a proton

C an atom of carbon-12

D an atom of hydrogen-1

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24. 0620_w20_qp_22 Q: 13

What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

A FeO **B** Fe_2O **C** Fe_2O_3 **D** Fe_3O_4

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25. 0620_w20_qp_23 Q: 11

The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

A a neutron

B a proton

C an atom of carbon-12

D an atom of hydrogen-1

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26. 0620_w20_qp_23 Q: 12

What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

A FeO **B** Fe_2O **C** Fe_2O_3 **D** Fe_3O_4

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27. 0620_m19_qp_22 Q: 8

An oxide of nitrogen has the following composition by mass: N, 30.4%; O, 69.6%.

It has a relative molecular mass of 92.

What is the molecular formula of the oxide of nitrogen?

A NO **B** NO_2 **C** NO_4 **D** N_2O_4

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28. 0620_s19_qp_21 Q: 7

Propane burns in oxygen.

$$C_3H_8 + xO_2 \rightarrow 3CO_2 + yH_2O$$

Which values of *x* and *y* balance the equation?

	x	*y*
A	5	4
B	7	4
C	10	8
D	13	8

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29. 0620_s19_qp_22 Q: 7

Calcium metal reacts with water to form a solution of calcium hydroxide and hydrogen gas.

Which equation is correct?

A $Ca(s) + H_2O(aq) \rightarrow CaOH(aq) + H(g)$

B $Ca(s) + 2H_2O(aq) \rightarrow Ca(OH)_2(s) + 2H_2(g)$

C $Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

D $Ca(s) + H_2O(l) \rightarrow CaOH(l) + H(g)$

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30. 0620_s19_qp_23 Q: 7

When propane burns in air, carbon dioxide and water are formed.

What is the chemical equation for this reaction?

A $C_3H_8 + 2O_2 \rightarrow CO_2 + 2H_2O$

B $C_3H_8 + 3O_2 \rightarrow 3CO_2 + H_2O$

C $C_3H_8 + 4O_2 \rightarrow 3CO_2 + 4H_2O$

D $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

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31. 0620_w19_qp_21 Q: 9

Four fertilisers are each supplied in 100 kg bags.

Which fertiliser supplies the greatest mass of nitrogen per 100 kg bag?

A ammonium nitrate, NH_4NO_3

B ammonium phosphate, $(NH_4)_3PO_4$

C ammonium sulfate, $(NH_4)_2SO_4$

D urea, $CO(NH_2)_2$

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32. 0620_w18_qp_21 Q: 9

Iron can react with sulfur to form two ionic compounds.

The iron is present as Fe^{2+} in one compound and as Fe^{3+} in the other compound.

The sulfur ion is present as S^{2-} in both compounds.

What are the formulae of the two compounds?

A FeS and Fe_2S_3

B FeS and Fe_3S_2

C FeS_2 and Fe_3S_2

D FeS_2 and Fe_2S_3

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33. 0620_w18_qp_22 Q: 9

The formulae of some ions are shown.

positive ion	negative ion
Ti^{4+}	PO_4^{3-}
Al^{3+}	SO_4^{2-}
Mg^{2+}	NO_3^-
K^+	Cl^-

Which formula is **not** correct?

A $Al_3(SO_4)_2$ **B** K_3PO_4 **C** $Mg(NO_3)_2$ **D** $TiCl_4$

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34. 0620_w18_qp_23 Q: 9

Iron(III) chromate is a yellow solid. It contains the ions Fe^{3+} and CrO_4^{2-}.

What is the formula of iron(III) chromate?

A $FeCrO_4$ **B** $Fe_3(CrO_4)_2$ **C** Fe_2CrO_4 **D** $Fe_2(CrO_4)_3$

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35. 0620_s17_qp_21 Q: 7

Aluminium reacts with fluorine.

$$x\mathrm{A}l(s) + y\mathrm{F}_2(g) \rightarrow z\mathrm{A}l\mathrm{F}_3(s)$$

Which values of *x*, *y* and *z* balance the equation?

	x	*y*	*z*
A	1	2	1
B	2	3	2
C	3	2	3
D	4	3	4

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36. 0620_s17_qp_22 Q: 7

Which equations are balanced?

1 $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

2 $ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + 2H_2O$

3 $Mg(NO_3)_2 + NaOH \rightarrow Mg(OH)_2 + 2NaNO_3$

4 $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

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37. 0620_s17_qp_23 Q: 7

Aqueous iron(III) sulfate and aqueous sodium hydroxide react to give a precipitate of iron(III) hydroxide and a solution of sodium sulfate.

What is the balanced equation for this reaction?

A $Fe_2(SO_4)_3(aq) + 2NaOH(aq) \rightarrow Fe(OH)_3(s) + Na_2SO_4(aq)$

B $Fe_2(SO_4)_3(aq) + 3NaOH(aq) \rightarrow Fe(OH)_3(s) + 3Na_2SO_4(aq)$

C $Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 2Fe(OH)_3(s) + 3Na_2SO_4(aq)$

D $2Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 4Fe(OH)_3(s) + 6Na_2SO_4(aq)$

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38. 0620_w17_qp_21 Q: 7

The equation for the reaction between barium chloride solution and dilute sulfuric acid is shown.

$$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$$

Which row shows the state symbols for this equation?

	$BaCl_2$	H_2SO_4	$BaSO_4$	$2HCl$
A	(aq)	(aq)	(s)	(aq)
B	(aq)	(l)	(s)	(aq)
C	(l)	(aq)	(s)	(l)
D	(aq)	(l)	(aq)	(l)

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39. 0620_w17_qp_22 Q: 7

The equation for the reaction between phosphorus and oxygen is shown.

$$xP_4 + yO_2 \rightarrow zP_2O_5$$

Which values of *x*, *y* and *z* balance the equation?

	x	*y*	*z*
A	1	5	2
B	1	10	2
C	2	5	2
D	2	10	1

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40. 0620_w17_qp_23 Q: 7

The equation represents the reaction between solid magnesium oxide and dilute hydrochloric acid to form magnesium chloride and water.

$$MgO + 2HCl \rightarrow MgCl_2 + H_2O$$

Which row shows the state symbols for hydrochloric acid, magnesium chloride and water?

	HCl	$MgCl_2$	H_2O
A	(aq)	(aq)	(l)
B	(aq)	(l)	(l)
C	(l)	(aq)	(aq)
D	(l)	(l)	(aq)

SN	Paper	Q. No.	Answer
01	0620_m21_qp_22	10	C
02	0620_s21_qp_21	9	B
03	0620_s21_qp_22	9	C
04	0620_s21_qp_23	9	B
05	0620_s21_qp_23	11	C
06	0620_s21_qp_23	12	B
07	0620_s21_qp_23	37	B
08	0620_w21_qp_21	6	D
09	0620_w21_qp_21	9	C
10	0620_w21_qp_22	9	A
11	0620_w21_qp_23	13	C
12	0620_m20_qp_22	8	B
13	0620_p20_qp_20	8	C
14	0620_p20_qp_20	9	B
15	0620_s20_qp_21	8	C
16	0620_s20_qp_22	8	D
17	0620_s20_qp_23	8	D
18	0620_w20_qp_21	11	C
19	0620_w20_qp_21	12	C
20	0620_w20_qp_21	13	C
21	0620_w20_qp_22	8	B
22	0620_w20_qp_22	9	C
23	0620_w20_qp_22	11	C
24	0620_w20_qp_22	13	C
25	0620_w20_qp_23	11	C
26	0620_w20_qp_23	12	C
27	0620_m19_qp_22	8	D
28	0620_s19_qp_21	7	A
29	0620_s19_qp_22	7	C
30	0620_s19_qp_23	7	D
31	0620_w19_qp_21	9	D
32	0620_w18_qp_21	9	A
33	0620_w18_qp_22	9	A
34	0620_w18_qp_23	9	D
35	0620_s17_qp_21	7	B
36	0620_s17_qp_22	7	B
37	0620_s17_qp_23	7	C
38	0620_w17_qp_21	7	A
39	0620_w17_qp_22	7	A
40	0620_w17_qp_23	7	A