

# Chapter 4

## Stoichiometry

### 4.1 Stoichiometry

01. 0620\_m21\_qp\_22 Q: 10

A compound has the formula  $\text{XF}_2$  and has a relative mass of 70.

What is element X?

- A gallium
- B germanium
- C sulfur
- D ytterbium



**Ace | GCSE**  
Paper Perfection, Crafted With Passion

---

02. 0620\_s21\_qp\_21 Q: 9

2.56 g of a metal oxide,  $\text{MO}_2$ , 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
-

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
- 

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?

	$V_2O$	$VCl_2$	$V_2O_3$
<b>A</b>	+1	-2	+2
<b>B</b>	+1	+2	+3
<b>C</b>	+2	-2	+2
<b>D</b>	+2	+2	+3

---

05. 0620\_s21\_qp\_23 Q: 11

The equation for the decomposition of calcium carbonate is shown.



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
- 

Paper Perfection, Crafted With Passion

#### 4.1. STOICHIOMETRY

06. 0620\_s21\_qp\_23 Q: 12

Gas syringe X contains  $100\text{ cm}^3$  of hydrogen bromide gas, HBr.

Gas syringe Y contains  $100\text{ cm}^3$  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  $\text{CO}_2$ .
- B The number of molecules of HBr equals the number of molecules of  $\text{CO}_2$ .
- 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  $\text{CO}_2$ .



AceIGCSE

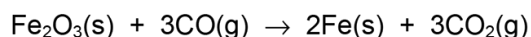
07. 0620\_s21\_qp\_23 Q: 37

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

- A  $0.24\text{ dm}^3$       B  $0.48\text{ dm}^3$       C  $0.96\text{ dm}^3$       D  $1.20\text{ dm}^3$

08. 0620\_w21\_qp\_21 Q: 6

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



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

09. 0620\_w21\_qp\_21 Q: 9

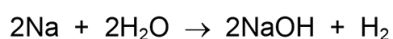
The formula of an aluminium ion is  $Al^{3+}$ .

What is the formula of aluminium sulfate?

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

10. 0620\_w21\_qp\_22 Q: 9

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



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

- A**  $9.6 \text{ dm}^3$       **B**  $15.0 \text{ dm}^3$       **C**  $19.2 \text{ dm}^3$       **D**  $30.0 \text{ dm}^3$
- 

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  $250 \text{ cm}^3$ ?

- A**  $0.075 \text{ mol/dm}^3$   
**B**  $0.30 \text{ mol/dm}^3$   
**C**  $1.2 \text{ mol/dm}^3$   
**D**  $1.5 \text{ mol/dm}^3$
- 

**AceIGCSE**  
Paper Perfection, Crafted With Passion

4.1. STOICHIOMETRY

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
<b>A</b>	aluminium oxide	$Al_2O_3$
<b>B</b>	iron(II) nitride	$Fe_2N_3$
<b>C</b>	sodium sulfate	$Na_2SO_4$
<b>D</b>	zinc nitrate	$Zn(NO_3)_2$

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

14. 0620\_p20\_qp\_20 Q: 9

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



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

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  $\text{FeSO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{aq})$   
 B  $\text{FeSO}_4(\text{l}) + 2\text{NaOH}(\text{l}) \rightarrow \text{Fe}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{l})$   
 C  $\text{Fe}_2(\text{SO}_4)_3(\text{aq}) + 6\text{NaOH}(\text{aq}) \rightarrow 2\text{Fe}(\text{OH})_3(\text{s}) + 3\text{Na}_2\text{SO}_4(\text{aq})$   
 D  $\text{Fe}_2(\text{SO}_4)_3(\text{l}) + 6\text{NaOH}(\text{aq}) \rightarrow 2\text{Fe}(\text{OH})_3(\text{s}) + 3\text{Na}_2\text{SO}_4(\text{l})$
- 

16. 0620\_s20\_qp\_22 Q: 8

Lead(II) nitrate,  $\text{Pb}(\text{NO}_3)_2$ , reacts with potassium iodide, KI, to form a yellow precipitate,  $\text{PbI}_2$ , and a soluble salt,  $\text{KNO}_3$ .

What is the equation for the reaction?

- A  $\text{Pb}(\text{NO}_3)_2 + \text{KI} \rightarrow \text{PbI}_2 + \text{KNO}_3$   
 B  $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + \text{KNO}_3$   
 C  $2\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$   
 D  $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
- 

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  $\text{FeO} + \text{Al} \rightarrow \text{AlO} + \text{Fe}$   
 B  $\text{Fe}_2\text{O} + 2\text{Al} \rightarrow \text{Al}_2\text{O} + 2\text{Fe}$   
 C  $\text{Fe}_2\text{O}_3 + \text{Al} \rightarrow \text{Al}_2\text{O}_3 + \text{Fe}$   
 D  $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$
- 

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.



What is the formula of the sodium salt?

- A  $\text{Na}_2(\text{SO}_4)_2$     B  $\text{Na}(\text{SO}_4)_2$     C  $\text{Na}_2\text{SO}_4$     D  $\text{NaSO}_4$
-

#### 4.1. STOICHIOMETRY

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
- 

20. 0620\_w20\_qp\_21 Q: 13

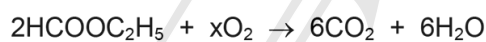
What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

- A FeO
  - B Fe<sub>2</sub>O
  - C Fe<sub>2</sub>O<sub>3</sub>
  - D Fe<sub>3</sub>O<sub>4</sub>
- 

21. 0620\_w20\_qp\_22 Q: 8

Ethyl methanoate, HCOOC<sub>2</sub>H<sub>5</sub>, burns in excess oxygen to produce carbon dioxide and water.

The equation is shown.



What is the value of x?

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

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 <sup>+</sup>
B	electron gained	Rb <sup>-</sup>
C	electron lost	Rb <sup>+</sup>
D	electron lost	Rb <sup>-</sup>

---

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
- 

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<sub>2</sub>O
  - C Fe<sub>2</sub>O<sub>3</sub>
  - D Fe<sub>3</sub>O<sub>4</sub>
- 

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
- 

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<sub>2</sub>O
  - C Fe<sub>2</sub>O<sub>3</sub>
  - D Fe<sub>3</sub>O<sub>4</sub>
- 

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.

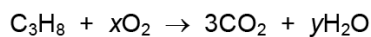
What is the molecular formula of the oxide of nitrogen?

- A NO
  - B NO<sub>2</sub>
  - C NO<sub>4</sub>
  - D N<sub>2</sub>O<sub>4</sub>
-

#### 4.1. STOICHIOMETRY

28. 0620\_s19\_qp\_21 Q: 7

Propane burns in oxygen.



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

	$x$	$y$
<b>A</b>	5	4
<b>B</b>	7	4
<b>C</b>	10	8
<b>D</b>	13	8

---

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**  $\text{Ca(s)} + \text{H}_2\text{O(aq)} \rightarrow \text{CaOH(aq)} + \text{H(g)}$
- B**  $\text{Ca(s)} + 2\text{H}_2\text{O(aq)} \rightarrow \text{Ca(OH)}_2\text{(s)} + 2\text{H}_2\text{(g)}$
- C**  $\text{Ca(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{H}_2\text{(g)}$
- D**  $\text{Ca(s)} + \text{H}_2\text{O(l)} \rightarrow \text{CaOH(l)} + \text{H(g)}$

---

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**  $\text{C}_3\text{H}_8 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
  - B**  $\text{C}_3\text{H}_8 + 3\text{O}_2 \rightarrow 3\text{CO}_2 + \text{H}_2\text{O}$
  - C**  $\text{C}_3\text{H}_8 + 4\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$
  - D**  $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$
-

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,  $\text{NH}_4\text{NO}_3$   
 B ammonium phosphate,  $(\text{NH}_4)_3\text{PO}_4$   
 C ammonium sulfate,  $(\text{NH}_4)_2\text{SO}_4$   
 D urea,  $\text{CO}(\text{NH}_2)_2$
- 

32. 0620\_w18\_qp\_21 Q: 9

Iron can react with sulfur to form two ionic compounds.

The iron is present as  $\text{Fe}^{2+}$  in one compound and as  $\text{Fe}^{3+}$  in the other compound.The sulfur ion is present as  $\text{S}^{2-}$  in both compounds.

What are the formulae of the two compounds?

- A  $\text{FeS}$  and  $\text{Fe}_2\text{S}_3$   
 B  $\text{FeS}$  and  $\text{Fe}_3\text{S}_2$   
 C  $\text{FeS}_2$  and  $\text{Fe}_3\text{S}_2$   
 D  $\text{FeS}_2$  and  $\text{Fe}_2\text{S}_3$
- 

33. 0620\_w18\_qp\_22 Q: 9

The formulae of some ions are shown.

positive ion	negative ion
$\text{Ti}^{4+}$	$\text{PO}_4^{3-}$
$\text{Al}^{3+}$	$\text{SO}_4^{2-}$
$\text{Mg}^{2+}$	$\text{NO}_3^-$
$\text{K}^+$	$\text{Cl}^-$

Which formula is **not** correct?

- A  $\text{Al}_3(\text{SO}_4)_2$     B  $\text{K}_3\text{PO}_4$     C  $\text{Mg}(\text{NO}_3)_2$     D  $\text{TiCl}_4$
-

#### 4.1. STOICHIOMETRY

34. 0620\_w18\_qp\_23 Q: 9

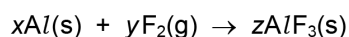
Iron(III) chromate is a yellow solid. It contains the ions  $\text{Fe}^{3+}$  and  $\text{CrO}_4^{2-}$ .

What is the formula of iron(III) chromate?

- A**  $\text{FeCrO}_4$       **B**  $\text{Fe}_3(\text{CrO}_4)_2$       **C**  $\text{Fe}_2\text{CrO}_4$       **D**  $\text{Fe}_2(\text{CrO}_4)_3$
- 

35. 0620\_s17\_qp\_21 Q: 7

Aluminium reacts with fluorine.



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

	$x$	$y$	$z$
<b>A</b>	1	2	1
<b>B</b>	2	3	2
<b>C</b>	3	2	3
<b>D</b>	4	3	4

---

36. 0620\_s17\_qp\_22 Q: 7

Which equations are balanced?

- 1  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
- 2  $\text{ZnCO}_3 + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{CO}_2 + 2\text{H}_2\text{O}$
- 3  $\text{Mg}(\text{NO}_3)_2 + \text{NaOH} \rightarrow \text{Mg}(\text{OH})_2 + 2\text{NaNO}_3$
- 4  $\text{CaCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{CO}_2$

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

37. 0620\_s17\_qp\_23 Q: 7

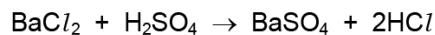
Aqueous iron(III) sulfate and aqueous sodium hydroxide react to give a precipitate of iron(III) hydroxide and a solution of sodium sulfate.

What is the balanced equation for this reaction?

- A**  $\text{Fe}_2(\text{SO}_4)_3(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s}) + \text{Na}_2\text{SO}_4(\text{aq})$
- B**  $\text{Fe}_2(\text{SO}_4)_3(\text{aq}) + 3\text{NaOH}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s}) + 3\text{Na}_2\text{SO}_4(\text{aq})$
- C**  $\text{Fe}_2(\text{SO}_4)_3(\text{aq}) + 6\text{NaOH}(\text{aq}) \rightarrow 2\text{Fe}(\text{OH})_3(\text{s}) + 3\text{Na}_2\text{SO}_4(\text{aq})$
- D**  $2\text{Fe}_2(\text{SO}_4)_3(\text{aq}) + 6\text{NaOH}(\text{aq}) \rightarrow 4\text{Fe}(\text{OH})_3(\text{s}) + 6\text{Na}_2\text{SO}_4(\text{aq})$
-

38. 0620\_w17\_qp\_21 Q: 7

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

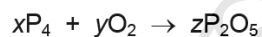


Which row shows the state symbols for this equation?

	$\text{BaCl}_2$	$\text{H}_2\text{SO}_4$	$\text{BaSO}_4$	$2\text{HCl}$
<b>A</b>	(aq)	(aq)	(s)	(aq)
<b>B</b>	(aq)	(l)	(s)	(aq)
<b>C</b>	(l)	(aq)	(s)	(l)
<b>D</b>	(aq)	(l)	(aq)	(l)

39. 0620\_w17\_qp\_22 Q: 7

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

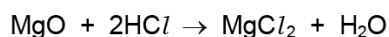


Which values of x, y and z balance the equation?

	x	y	z
<b>A</b>	1	5	2
<b>B</b>	1	10	2
<b>C</b>	2	5	2
<b>D</b>	2	10	1

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.



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

	$\text{HCl}$	$\text{MgCl}_2$	$\text{H}_2\text{O}$
<b>A</b>	(aq)	(aq)	(l)
<b>B</b>	(aq)	(l)	(l)
<b>C</b>	(l)	(aq)	(aq)
<b>D</b>	(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