

4.2. THE MOLE CONCEPT

01. 0620_m16_qp_22 Q: 9

Magnesium nitride is formed when magnesium burns in air. Magnesium nitride is an ionic compound.

What is the formula of magnesium nitride?

- A** MgN_2 **B** Mg_2N_2 **C** Mg_2N_3 **D** Mg_3N_2
-

02. 0620_p16_qp_20 Q: 8

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

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

4.2 The mole concept

03. 0620_m20_qp_22 Q: 9

The equation for the decomposition of magnesium nitrate is shown.



Which volume of gas is produced when 0.1 moles of magnesium nitrate is decomposed completely?

- A** 1.2 dm^3 **B** 4.8 dm^3 **C** 6.0 dm^3 **D** 8.4 dm^3
-

04. 0620_p20_qp_20 Q: 10

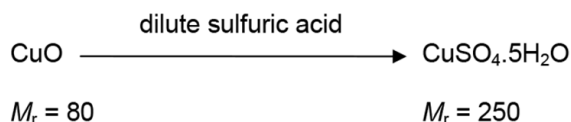
What is the concentration of a solution containing 1.0g of sodium hydroxide in 250 cm^3 of solution?

- A** 0.025 mol/dm^3
B 0.10 mol/dm^3
C 0.25 mol/dm^3
D 1.0 mol/dm^3
-

05. 0620_p20_qp_20 Q: 11

Four students prepared hydrated copper(II) sulfate by adding an excess of dilute sulfuric acid to copper(II) oxide.

Each student used a different mass of copper(II) oxide.



After the copper(II) sulfate had crystallised the students dried and weighed the crystals.

Which student produced the highest percentage yield of hydrated copper(II) sulfate?

	mass of copper(II) oxide used / g	mass of crystals produced / g
A	4.0	11.5
B	8.0	23.5
C	12.0	35.0
D	16.0	46.5

06. 0620_p20_qp_20 Q: 12

20 cm³ of ethyne, C₂H₂, are reacted with 500 cm³ of oxygen.

The equation for the reaction is



What is the total volume of gas remaining at the end of the reaction?

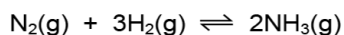
(all volumes are measured at room temperature and pressure)

- A** 400 cm³
- B** 450 cm³
- C** 490 cm³
- D** 520 cm³

4.2. THE MOLE CONCEPT

07. 0620_s20_qp_21 Q: 9

The Haber process is a reversible reaction.



The reaction has a 30% yield of ammonia.

Which volume of ammonia gas, NH_3 , measured at room temperature and pressure, is obtained by reacting 0.75 moles of hydrogen with excess nitrogen?

- A** 3600 cm^3 **B** 5400 cm^3 **C** 12000 cm^3 **D** 18000 cm^3
-

08. 0620_m19_qp_22 Q: 9

Calcium carbonate reacts with dilute hydrochloric acid according to the equation shown.



10 g of calcium carbonate is reacted with 100 cm^3 of 1 mol/dm^3 hydrochloric acid.

The following statements are made.

- 1 1.2 dm^3 of carbon dioxide is formed.
- 2 5.6 g of calcium chloride is formed.
- 3 4.8 g of carbon dioxide is formed.
- 4 No calcium carbonate is left when the reaction is completed.

Which statements about the reaction are correct?

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

09. 0620_s19_qp_21 Q: 8

A tablet contains 0.080 g of ascorbic acid ($M_r = 176$).

What is the concentration of ascorbic acid when one tablet is dissolved in 200 cm^3 of water?

- A** $9.1 \times 10^{-5} \text{ mol/dm}^3$
B $4.5 \times 10^{-4} \text{ mol/dm}^3$
C $9.1 \times 10^{-2} \text{ mol/dm}^3$
D $2.3 \times 10^{-3} \text{ mol/dm}^3$
-

10. 0620_s19_qp_22 Q: 8

25.0 cm³ of 0.100 mol/dm³ aqueous sodium hydroxide is neutralised by 24.6 cm³ of dilute sulfuric acid.

What is the concentration of the dilute sulfuric acid?

- A 0.0508 mol/dm³
 - B 0.0984 mol/dm³
 - C 0.102 mol/dm³
 - D 0.203 mol/dm³
-

11. 0620_s19_qp_23 Q: 8

What is the concentration of a solution that contains 25.0 g NaOH in 500 cm³ of water?

- A 0.125 mol/dm³
 - B 0.800 mol/dm³
 - C 1.25 mol/dm³
 - D 3.20 mol/dm³
-

12. 0620_w19_qp_21 Q: 10

Calcium carbonate reacts with dilute hydrochloric acid.

The equation for the reaction is shown.



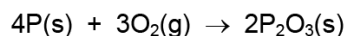
1.00 g of calcium carbonate is added to 50.0 cm³ of 0.0500 mol/dm³ hydrochloric acid.

Which volume of carbon dioxide is made in this reaction?

- A 30 cm³
 - B 60 cm³
 - C 120 cm³
 - D 240 cm³
-

13. 0620_w19_qp_22 Q: 9

Phosphorus reacts with oxygen to form phosphorus(III) oxide as shown.



Which mass of phosphorus(III) oxide is produced from 6.2 g of phosphorus?

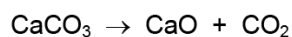
- A 1.1 g
 - B 5.5 g
 - C 11.0 g
 - D 22.0 g
-

4.2. THE MOLE CONCEPT

14. 0620_w19_qp_22 Q: 10

Calcium carbonate is heated. Calcium oxide and carbon dioxide gas are formed.

The equation for the reaction is shown.



225 kg of calcium carbonate is heated until there is no further change in mass.

The yield of calcium oxide is 85 kg.

What is the percentage yield?

- A** 37.8% **B** 47.2% **C** 67.5% **D** 85.0%
-

15. 0620_w19_qp_23 Q: 9

Magnesium carbonate decomposes on heating to form magnesium oxide and carbon dioxide as shown.



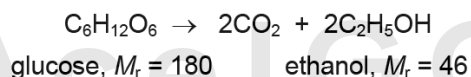
How much magnesium carbonate is needed to make 5.0 g of magnesium oxide?

- A** 3.5 g **B** 4.0 g **C** 6.5 g **D** 10.5 g
-

16. 0620_w19_qp_23 Q: 10

90 g of glucose is dissolved in water.

The glucose solution is fermented.



After the fermentation finishes, 6.8 g of ethanol is obtained from the solution.

What is the percentage yield of ethanol?

- A** 7.4 **B** 7.6 **C** 14.8 **D** 29.6
-

17. 0620_m18_qp_22 Q: 7

The concentration of a hydrochloric acid solution is 0.5 mol/dm^3 .

How many moles of hydrochloric acid are present in 25 cm^3 of this solution?

- A** 0.0125 **B** 0.0200 **C** 12.5 **D** 20.0
-

18. 0620_m18_qp_22 Q: 8

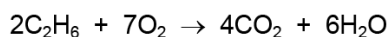
A sample of an iron oxide contains 50.4 g of iron and 21.6 g of oxygen.

What is the empirical formula of the iron oxide?

- A** FeO **B** FeO₃ **C** Fe₂O₃ **D** Fe₃O₂
-

19. 0620_s18_qp_21 Q: 8

The equation for the combustion of ethane is shown.



Which volume of carbon dioxide, at room temperature and pressure, is formed when 0.5 moles of ethane burn?

- A** 48 dm³ **B** 24 dm³ **C** 12 dm³ **D** 6 dm³
-

20. 0620_s18_qp_21 Q: 9

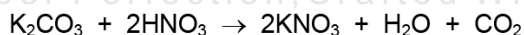
A solution of ethanoic acid, CH₃COOH, has a concentration of 2 mol/dm³.

Which statement about this solution is correct?

- A** 20 g of ethanoic acid is dissolved in 10 cm³ of water.
B 30 g of ethanoic acid is dissolved in 250 cm³ of water.
C 60 g of ethanoic acid is dissolved in 1 dm³ of water.
D 120 g of ethanoic acid is dissolved in 2 dm³ of water.
-

21. 0620_s18_qp_22 Q: 8

The equation for the reaction between potassium carbonate and nitric acid is shown.



Which volume of carbon dioxide is produced from 69 g of potassium carbonate?

- A** 6 dm³ **B** 12 dm³ **C** 24 dm³ **D** 48 dm³
-

22. 0620_s18_qp_22 Q: 9

A solution of sodium carbonate, Na₂CO₃, has a concentration of 0.03 mol/dm³.

Which mass of sodium carbonate is dissolved in 1 dm³ of this solution?

- A** 1.06 g **B** 3.18 g **C** 10.60 g **D** 31.80 g
-

4.2. THE MOLE CONCEPT

23. 0620_s18_qp_23 Q: 8

An experiment was done to determine the formula of a hydrocarbon, C_xH_y .

10 cm^3 of the gaseous hydrocarbon, C_xH_y , was burned in an excess of oxygen to form 20 cm^3 of carbon dioxide and 30 cm^3 of water vapour.

What is C_xH_y ?

- A** CH_4 **B** C_2H_4 **C** C_2H_6 **D** C_3H_8
-

24. 0620_s18_qp_23 Q: 9

4.00 g of solid sodium hydroxide is added to water to make a solution with a concentration of 0.200 mol/dm^3 .

What is the volume of water used?

- A** 0.5 cm^3 **B** 20 cm^3 **C** 500 cm^3 **D** 2000 cm^3
-

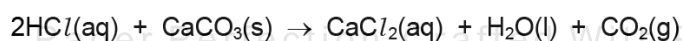
25. 0620_w18_qp_21 Q: 7

Which gas sample contains the most molecules?

- A** 24 dm^3 of carbon dioxide, CO_2
B 4 g of hydrogen, H_2
C 36 dm^3 of hydrogen chloride, HCl
D 14 g of nitrogen, N_2
-

26. 0620_w18_qp_21 Q: 8

A student mixed together 25.0 cm^3 of 1.00 mol/dm^3 hydrochloric acid and 25.0 g of calcium carbonate.



What is the maximum volume of carbon dioxide gas that could be collected at room temperature and pressure?

- A** 300 dm^3 **B** 6.00 dm^3 **C** 0.600 dm^3 **D** 0.300 dm^3
-

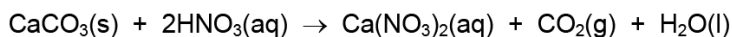
27. 0620_w18_qp_22 Q: 7

Which gas sample contains the smallest number of molecules?

- A** 4 g of helium
B 16 g of oxygen
C 28 g of carbon monoxide
D 28 g of nitrogen
-

28. 0620_w18_qp_22 Q: 8

The equation for the reaction between calcium carbonate and dilute nitric acid is shown.



25g of calcium carbonate is reacted with an excess of dilute nitric acid.

Which mass of calcium nitrate and which volume of carbon dioxide is produced at room temperature and pressure?

	mass of calcium nitrate/g	volume of carbon dioxide/dm ³
A	29	6
B	29	12
C	41	6
D	41	12

29. 0620_w18_qp_23 Q: 7

Which gas sample has the greatest mass?

- A** 5.0 moles of Cl_2
- B** 10.0 moles of O_2
- C** 15.0 moles of N_2
- D** 20.0 moles of H_2

30. 0620_w18_qp_23 Q: 8

Which sample of magnesium chloride, MgCl_2 , contains the same number of moles as 69.6 g of potassium sulfate, K_2SO_4 ?

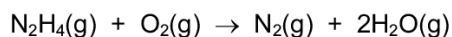
- A** 19.0g
- B** 28.5g
- C** 38.0g
- D** 47.5g

4.2. THE MOLE CONCEPT

31. 0620_m17_qp_22 Q: 8

The gas hydrazine has the molecular formula N_2H_4 .

Hydrazine burns in air to form nitrogen gas and steam.



Which statements are correct?

- 1 1 mole of hydrazine gives 72 dm^3 of gaseous products when it reacts with oxygen at room temperature and pressure.
- 2 The empirical formula of hydrazine is NH_2 .
- 3 The total number of atoms in 1 mole of hydrazine is $6 \times$ the Avogadro constant.
- 4 The volume of 1 mole of hydrazine at room temperature and pressure is $6 \times 24 \text{ dm}^3$.

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

32. 0620_m17_qp_22 Q: 9

Copper(II) carbonate is broken down by heating to form copper(II) oxide and carbon dioxide gas.

The equation for the reaction is shown.



31.0g of copper(II) carbonate are heated until all of the contents of the test-tube have turned from green to black.

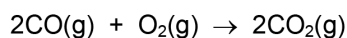
The yield of copper(II) oxide formed is 17.5g.

What is the percentage yield?

A 19.02% **B** 21.88% **C** 56.50% **D** 87.50%

33. 0620_s17_qp_21 Q: 8

Carbon monoxide burns in oxygen to produce carbon dioxide.



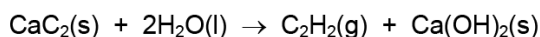
Which mass of carbon dioxide is produced from 14g of carbon monoxide?

A 22g **B** 28g **C** 44g **D** 88g

34. 0620_s17_qp_22 Q: 8

Calcium carbide, CaC_2 , reacts with water to form ethyne, C_2H_2 , and calcium hydroxide.

The equation for the reaction is shown.

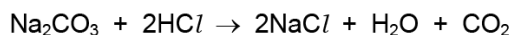


Which volume of ethyne is produced when 6 g of water react completely with calcium carbide?

- A 4 dm³ B 8 dm³ C 36 dm³ D 72 dm³

35. 0620_s17_qp_23 Q: 8

The equation for the reaction between sodium carbonate and dilute hydrochloric acid is shown.



What is the maximum volume of carbon dioxide produced when 26.5 g of sodium carbonate react with dilute hydrochloric acid?

- A 6 dm³ B 12 dm³ C 18 dm³ D 24 dm³

36. 0620_w17_qp_21 Q: 8

A compound is analysed and found to contain 85.7% carbon and 14.3% hydrogen.

What is its empirical formula?

- A CH B CH₂ C C₂H₄ D C₆H

37. 0620_w17_qp_22 Q: 8

The relative molecular mass of an alcohol is 88.

Its percentage composition by mass is: C, 54.5%; H, 9.1%; O, 36.4%.

Which row shows the empirical formula and molecular formula for this alcohol?

	empirical formula	molecular formula
A	C ₂ H ₄ O	C ₂ H ₄ O
B	C ₂ H ₄ O	C ₄ H ₈ O ₂
C	C ₄ H ₈ O ₂	C ₄ H ₈ O ₂
D	C ₄ H ₈ O ₂	C ₂ H ₄ O

4.2. THE MOLE CONCEPT

38. 0620_w17_qp_23 Q: 8

A compound contains 34.5% calcium, 24.1% silicon and 41.4% oxygen by mass.

What is its empirical formula?

- A** Ca_2SiO_3 **B** CaSiO_3 **C** CaSi_2O_3 **D** CaSiO_6
-

39. 0620_m16_qp_22 Q: 8

Which quantities of chemicals will react exactly with no reactants left over?

- A** 12 g of carbon and 12 g of oxygen
B 12 g of carbon and 48 g of oxygen
C 12 g of magnesium and 16 g of oxygen
D 24 g of magnesium and 16 g of oxygen
-

40. 0620_p16_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
-

41. 0620_p16_qp_20 Q: 10

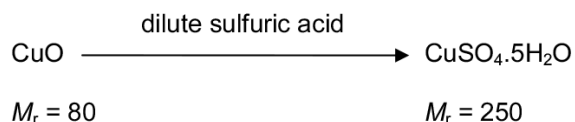
What is the concentration of a solution containing 1.0 g of sodium hydroxide in 250cm^3 of solution?

- A** 0.025mol/dm^3
B 0.10mol/dm^3
C 0.25mol/dm^3
D 1.0mol/dm^3
-

42. 0620_p16_qp_20 Q: 11

Four students prepared hydrated copper(II) sulfate by adding an excess of dilute sulfuric acid to copper(II) oxide.

Each student used a different mass of copper(II) oxide.



After the copper(II) sulfate had crystallised the students dried and weighed the crystals.

Which student produced the highest percentage yield of hydrated copper(II) sulfate?

	mass of copper(II) oxide used / g	mass of crystals produced / g
A	4.0	11.5
B	8.0	23.5
C	12.0	35.0
D	16.0	46.5

43. 0620_p16_qp_20 Q: 12

20 cm³ of ethyne, C₂H₂, are reacted with 500 cm³ of oxygen.

The equation for the reaction is



What is the total volume of gas remaining at the end of the reaction?

(all volumes are measured at room temperature and pressure)

- A** 400 cm³
B 450 cm³
C 490 cm³
D 520 cm³

44. 0620_s16_qp_21 Q: 8

A compound, X, contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass.

The relative molecular mass, M_r , of X is 60.

What is the molecular formula of X?

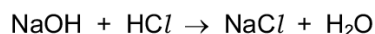
- A** CH₂O **B** CH₄O **C** C₂H₄O **D** C₂H₄O₂

4.2. THE MOLE CONCEPT

45. 0620_s16_qp_21 Q: 9

25 cm³ of 0.1 mol/dm³ hydrochloric acid exactly neutralise 20 cm³ of aqueous sodium hydroxide.

The equation for this reaction is:



What is the concentration of the sodium hydroxide solution?

- A 0.080 mol/dm³
 - B 0.800 mol/dm³
 - C 0.125 mol/dm³
 - D 1.25 mol/dm³
-

46. 0620_s16_qp_22 Q: 8

A sample of 16.0 g of a metal oxide, MO, is reduced to 12.8 g of the metal, M.

What is the relative atomic mass, A_r , of M?

- A 32
 - B 64
 - C 80
 - D 128
-

47. 0620_s16_qp_22 Q: 9

The equation for the reaction between calcium carbonate and hydrochloric acid is shown.



How many moles of calcium carbonate will give 24 cm³ of carbon dioxide when reacted with an excess of the acid?

- A 1 mol
 - B 0.1 mol
 - C 0.01 mol
 - D 0.001 mol
-

48. 0620_s16_qp_23 Q: 8

Analysis of a compound formed between magnesium and nitrogen showed it contained 14.4 g of magnesium and 5.6 g of nitrogen.

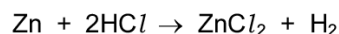
What is the empirical formula of the compound?

- A Mg₂N₃
 - B Mg₃N₂
 - C Mg₄N₆
 - D Mg₆N₄
-

49. 0620_s16_qp_23 Q: 9

An excess of zinc is added to 100 cm³ of 1.0 mol/dm³ hydrochloric acid.

The equation for the reaction is:



What is the maximum volume of hydrogen evolved at room temperature and pressure?

- A** 1.2 dm³ **B** 2.0 dm³ **C** 2.4 dm³ **D** 24 dm³
-

50. 0620_w16_qp_21 Q: 8

Benzene is a liquid with molecular formula C₆H₆.

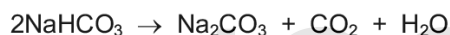
Ethene is a gas with molecular formula C₂H₄.

Which statement is correct?

- A** 1 mole of benzene and 1 mole of ethene contain the same number of atoms.
B 1 mole of benzene and 1 mole of ethene both have a volume of 24 dm³ at room temperature and pressure.
C Both benzene and ethene have the same empirical formula.
D The number of carbon atoms in 0.5 moles of ethene is equal to the Avogadro constant.
-

51. 0620_w16_qp_21 Q: 9

Sodium hydrogencarbonate undergoes thermal decomposition as shown.



What is the maximum mass of sodium carbonate that can be made from 0.100 moles of sodium hydrogencarbonate?

- A** 4.15g **B** 5.30g **C** 10.6g **D** 21.2g
-

52. 0620_w16_qp_22 Q: 8

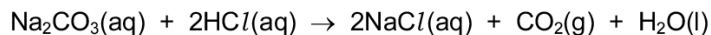
Which sample contains the greatest number of molecules?

- A** 4 g of hydrogen
B 18 g of water
C 24 dm³ of oxygen
D 66 g of carbon dioxide
-

4.2. THE MOLE CONCEPT

53. 0620_w16_qp_22 Q: 9

Sodium carbonate solution reacts with dilute hydrochloric acid. The equation for the reaction is shown.



Excess sodium carbonate is added to 10.0 cm^3 of 0.10 mol/dm^3 hydrochloric acid.

Which volume of carbon dioxide gas is made?

- A** 12 cm^3 **B** 24 cm^3 **C** 12000 cm^3 **D** 24000 cm^3
-

54. 0620_w16_qp_23 Q: 8

The equation shows the complete combustion of propane.



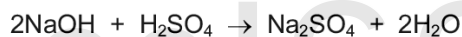
Which statement is correct?

- A** 10 cm^3 of propane cannot burn if less than 50 cm^3 of oxygen is present.
B 10 cm^3 of propane would produce 40 cm^3 of liquid water.
C 100 cm^3 of oxygen would be sufficient to react completely with 20 cm^3 of propane.
D This reaction would result in an increase in the volume of gas.
-

55. 0620_w16_qp_23 Q: 9

Sodium hydroxide reacts with sulfuric acid.

The equation for the reaction is shown.



Which volume of 0.4 mol/dm^3 sodium hydroxide reacts with 50.0 cm^3 of 0.1 mol/dm^3 sulfuric acid?

- A** 12.5 cm^3 **B** 25.0 cm^3 **C** 50.0 cm^3 **D** 100.0 cm^3
-

SN	Paper	Q. No.	Answer
01	0620_m16_qp_22	9	D
02	0620_p16_qp_20	8	C
03	0620_m20_qp_22	9	C
04	0620_p20_qp_20	10	B
05	0620_p20_qp_20	11	B
06	0620_p20_qp_20	12	C
07	0620_s20_qp_21	9	A
08	0620_m19_qp_22	9	A
09	0620_s19_qp_21	8	D
10	0620_s19_qp_22	8	A
11	0620_s19_qp_23	8	C
12	0620_w19_qp_21	10	A
13	0620_w19_qp_22	9	C
14	0620_w19_qp_22	10	C
15	0620_w19_qp_23	9	D
16	0620_w19_qp_23	10	C
17	0620_m18_qp_22	7	A
18	0620_m18_qp_22	8	C
19	0620_s18_qp_21	8	B
20	0620_s18_qp_21	9	B
21	0620_s18_qp_22	8	B
22	0620_s18_qp_22	9	B
23	0620_s18_qp_23	8	C
24	0620_s18_qp_23	9	C
25	0620_w18_qp_21	7	B
26	0620_w18_qp_21	8	D
27	0620_w18_qp_22	7	B
28	0620_w18_qp_22	8	C
29	0620_w18_qp_23	7	C
30	0620_w18_qp_23	8	C
31	0620_m17_qp_22	8	A
32	0620_m17_qp_22	9	D
33	0620_s17_qp_21	8	A
34	0620_s17_qp_22	8	A
35	0620_s17_qp_23	8	A
36	0620_w17_qp_21	8	B
37	0620_w17_qp_22	8	B
38	0620_w17_qp_23	8	B
39	0620_m16_qp_22	8	D
40	0620_p16_qp_20	9	B
41	0620_p16_qp_20	10	B
42	0620_p16_qp_20	11	B
43	0620_p16_qp_20	12	C
44	0620_s16_qp_21	8	D
45	0620_s16_qp_21	9	C
46	0620_s16_qp_22	8	B
47	0620_s16_qp_22	9	D
48	0620_s16_qp_23	8	B
49	0620_s16_qp_23	9	A

SN	Paper	Q. No.	Answer
50	0620_w16_qp_21	8	D
51	0620_w16_qp_21	9	B
52	0620_w16_qp_22	8	A
53	0620_w16_qp_22	9	A
54	0620_w16_qp_23	8	C
55	0620_w16_qp_23	9	B