

RAM | RMM | RFM

[SBPmidYear06-30] The proton number of sodium atom is 11 and its molar mass is 23 gmol^{-1} . What is the relative atomic mass of sodium atom?

- A 11
- B 12
- C 23
- D 34

[SBPmidYear07F4-08] The chemical formula for aluminium sulphate is $\text{Al}_2(\text{SO}_4)_3$. What is its relative formula mass?

[Relative atomic mass: O=16, Al=27, S=32]

- A 123
- B 150
- C 182
- D 342

[MRSM11-22] The chemical formula for tetrachloromethane is CCl_4 .

What is the relative molecular mass of tetrachloromethane?

[Relative atomic mass: C, 12; Cl, 35.5]

- A 54.0
- B 118.5
- C 83.0
- D 47.5

[SBPmidYear06-22] What is the relative molecular mass of tetrachloromethane, CCl_4 ?

[Relative atomic mass: C=12, Cl=35.5]

- A 71
- B 142
- C 154
- D 184

[SBPmidYearF508-03] What is the relative molecular mass of hydrated magnesium sulphate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$? [Relative atomic mass: Mg=24; S=32; O=16; H=1]

- A 145
- B 246
- C 305
- D 356

[SPM06-37] The chemical formula for potassium hexacyanoferrate(III) is $\text{K}_3\text{Fe}(\text{CN})_6$.

What is its relative formula mass? [Relative atomic mass: C=12, N=14, K=39, Fe=56]

- A 121
- B 199
- C 251
- D 329

[MRSM04–36] The information regarding elements M and T are as follows:

Element	M	T
Proton number	12	9
Number of neutron	12	10

What is the molar mass of the compound formed when M and T react with each other?

- A 62 g mol⁻¹
- B 43 g mol⁻¹
- C 32 g mol⁻¹
- D 30 g mol⁻¹

[MRSM10-37] Table 6 shows the electron arrangement and nucleon number for atoms E and G.

	Atom E	Atom G
Electron arrangement	2.8.3	2.8.7
Nucleon number	27	35

Table 6

Based on Table 6, what is the relative molecular mass for compound formed when E reacts with G?

- A 62
- B 64
- C 97
- D 132

[SBPTrial10-02] The relative formula mass hydrated X carbonate. $X_2CO_3 \cdot 10H_2O$ is 286. What is the relative atomic mass of element X?
[Relative atomic mass: H=1, C=12, O=16]

- A 23
- B 46
- C 120
- D 240

[SPM10-15] The electron arrangement of atom U is 2.8.1 and atom V is 2.8.7. What is the molar mass of a compound formed when atom U combines with atom V?
[Relative atomic mass: U = 23: V = 35.5]

- A 152.5 g mol⁻¹
- B 94.0 g mol⁻¹
- C 81.5 g mol⁻¹
- D 58.5 g mol⁻¹

[SPM11-06] The average mass of a magnesium atom is 24 times greater than $\frac{1}{2}$ of the mass of a carbon-12 atom. What is the relative atomic mass of magnesium?

- A 2
- B 12
- C 24
- D 48

[SBPdiag06-02] How many times are 2 copper atoms heavier than an oxygen atom?
[Relative atomic mass: O=16, Cu=64]

- A 4
- B 8
- C 16
- D 64

[SPM08-41] The mass of three atoms of element X is equal to the mass of four carbon atoms. X is not the actual symbol of the element.
What is the relative atomic mass of element X? [Relative atomic mass of C=12]

- A 48
- B 36
- C 16
- D 12

[SBPmidYear07F4-06] The mass of two atoms of element X is equal to that of three atoms of sulphur. What is the relative atomic mass of element X?
[Relative atomic mass: S=32]

- A 96
- B 48
- C 32
- D 24

[SBPdiag08-34] 8 atoms of element Z have the same mass as in 1 atom of tellurium, Te.
Based on the statement above, what is the relative atomic mass of element Z?
Relative atomic mass: Te=128]

- A 8
- B 16
- C 32
- D 64

[SPM11-30] Table 2 shows the proton number and the nucleon number of atoms of elements X and Y. X and Y are not the actual symbols of the elements.

Element	Proton number	Nucleon number
X	13	27
Y	8	16

Table 2

Element X reacts with element Y to form a compound. What is the molar mass of the compound?

- A 43 g mol⁻¹
- B 50 g mol⁻¹
- C 102 g mol⁻¹
- D 113 g mol⁻¹

[SPM10-06] Element J and element Q have proton number of 12 and 9 respectively. What is the relative formula mass of a compound formed between J and Q?

[Relative atomic mass: J = 24; Q = 19]

- A 30
- B 43
- C 62
- D 67

The Mole

[MRSM06-03] What is the definition of a mole?

- A The volume occupied by 6.02×10^{23} particles
- B The atomic mass of a substance which consist of 6.02×10^{23} atoms
- C The molecular mass of a substance which consist of 6.02×10^{23} molecules
- D The quantity of a substance which has the same number of particles as the number of atoms in 12.00 g of carbon-12

[SBPmidYear06-02] The relative atomic mass of an element X is defined as

- A $\frac{\text{Mass of one atom of X}}{1/12 \times \text{mass of one carbon-12 atom}}$
- B $\frac{12 \times \text{mass of one atom of X}}{\text{Mass of one carbon-12 atom}}$
- C $\frac{\text{Mass of one atom of X}}{12 \times \text{mass of one carbon-12 atom}}$
- D $\frac{\text{Mass of one mole of atom X}}{1/12 \times \text{mass of one carbon-12 atom}}$

[SBPdiag07-21] Which of the following is correct for relative molecular mass?

- A $\frac{\text{Mass of an atom}}{1/12 \times \text{mass of one carbon-12 atom}}$
- B $\frac{\text{Mass of one molecule}}{1/12 \times \text{mass of one carbon-12 molecule}}$
- C $\frac{\text{Mass of one molecule}}{1/12 \times \text{mass of one carbon-12 atom}}$
- D $\frac{\text{Mass of an atom}}{1/12 \times \text{mass of one carbon-12 molecule}}$

[SPM06-04] Which of the following statements is true for one mole of a substance?

- A 1 mol of copper contains 6.02×10^{23} molecules
- B 1 mol of oxygen gas contains 6.02×10^{23} atoms
- C 1 mol of water contains the same number of atoms as in 12g of carbon-12
- D 1 mol of carbon dioxide contains the same number of molecules as the number of atoms in 12 g of carbon-12

[MRSM10-03] Calcium carbonate, CaCO_3 is the main component of marble. How many moles of atom of each element is present in 1 mol of calcium carbonate?

	Calcium, Ca	Carbon, C	Oxygen, O
A	1	1	3
B	2	1	3
C	1	2	6
D	2	2	6

The Mole and The Particles

[SPM11-35] What is the number of atoms in 0.5 mol of ammonia gas, NH_3 ?
[Avogadro constant = $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 6.02×10^{23}
- B $0.5 \times 6.02 \times 10^{23}$
- C $0.5 \times 2 \times 6.02 \times 10^{23}$
- D $0.5 \times 4 \times 6.02 \times 10^{23}$

[SBPmidYearF5-03] Avogadro number is the number of
[Relative atomic mass: He=4, C=12, Cl=35.5 and Ca=40]

- A atoms in 12 g of carbon-12
- B atoms in 8 g of helium
- C molecules in 35.5 g of chlorine
- D chloride ions in 11 g of calcium chloride

[SPM07-03] A balloon contains 6.02×10^{23} of gas particle. What is the number of moles of the gas in the balloon?

- A 0.5 mol
- B 1.0 mol
- C 3.0 mol
- D 6.0 mol

[SPM07-04] One mole of a substance is defined as the quantity of a substance that contains the same number of particles as in m g of element Y. What are m and Y?

	m	Y
A	2	Hydrogen-1
B	12	Carbon -12
C	14	Nitrogen -14
D	16	Oxygen-16

[SPM04-36] What is the number of molecules in 1 mole of ammonia, NH_3 ?
[Avogadro constant = $6.0 \times 10^{23} \text{ mol}^{-1}$]

- A 1.5×10^{23} molecules
- B 6.0×10^{23} molecules
- C 1.2×10^{24} molecules
- D 2.4×10^{24} molecules

[SBPmidYear07F4-07] What is the number of molecules in 1 mole of ammonia, NH_3 ?
[Avogadro constant = $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 6.02×10^{23} molecules
- B 1.204×10^{23} molecules
- C 1.505×10^{23} molecules
- D 2.408×10^{23} molecules

[SBPdiag08-26] How many molecules of bromine are there in 0.045 mol of bromine?
[Avogadro Constant ; $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 2.7×10^{22}
- B 3×10^{23}
- C 7.9×10^{24}
- D 1.2×10^{25}

[SBPTrial10-14] Which of the following substance contains 1.204×10^{24} atoms?

- A 1 mol of nitrogen gas
- B 1 mol of ammonia
- C 1 mol of water
- D 1 mol of argon

[SPM08-30] Which of the following contains 6.02×10^2 atoms?

- A 1 mol of nitrogen gas
- B 1 mol of chlorine gas
- C 1 mol of ammonia
- D 1 mol of neon

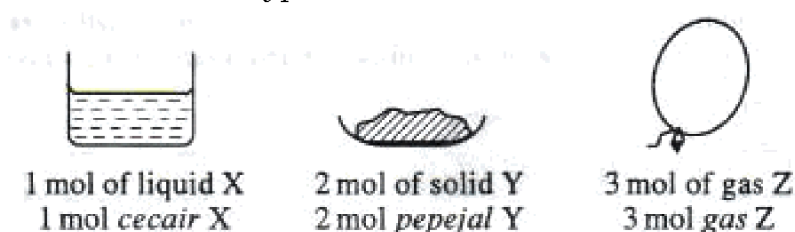
[SBPmidYearF5-26] What is the number of atoms in 1 mole of ammonia, NH_3 ?
[Avogadro Constant, $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 6.02×10^{23}
- B 2.408×10^{24}
- C 1.806×10^{23}
- D 1.2×10^{24}

[SBPmidYearF508-13] What is the number of oxygen atom in 0.1 mole of water?
[Avogadro constant, $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 6.02×10^{22}
- B 6.02×10^{23}
- C 60.2×10^{23}
- D 3.01×10^{23}

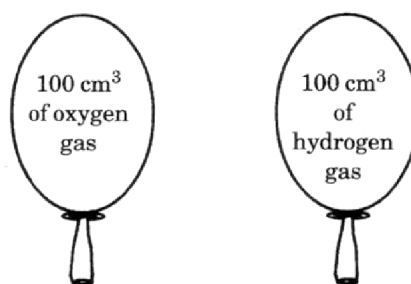
[SPM07-05] Diagram 2 shows three types of substances.



Which of the following is true about the substance in diagram 2?

- I the number of particles is gas Z is $3 \times 6.02 \times 10^{23}$
 II all the substances have only 6.02×10^{23} particles
 III the number of particles in liquid X is less than in gas Z
 IV the number of particles in solid Y is two times greater than in liquid X
- A I and II only
 B III and IV only
 C I, II and IV only
 D I, III and IV only

[SPM05-24] The diagram shows two balloons filled with oxygen gas and hydrogen gas respectively.



Which of the following statements is true about the two gases?

- A the number of moles of oxygen gas is greater than oxygen gas
 B the number of moles of oxygen gas and hydrogen gas equal
 C the number of oxygen gas molecules is greater than hydrogen gas molecules
 D the number of oxygen gas molecules is fewer than hydrogen gas molecules.

The Mol and The Mass

[SPM08-38] What is the number of moles of copper (II) nitrate in 56.4g of copper (II) nitrate, $\text{Cu}(\text{NO}_3)_2$? [Relative atomic mass: O=16, Cu=64, N=14]

- A 0.30 mol
 B 0.32 mol
 C 0.45 mol
 D 3.33 mol

The Mole and The Volume

[SPM07-36] Which of the following gases contains 0.4 mol of atoms at room temperature and pressure? [1 mol of gas occupies the volume of 24 dm^3 at room temperature and pressure]

- A 4.8 dm^3 He
 B 4.8 dm^3 H_2
 C 4.8 dm^3 SO_3
 D 4.8 dm^3 CO_2

The Mole, The Number of Particles, The Mass and The Volume

[SPM11-21] Diagram 4 shows two types of gases filled in two balloons.

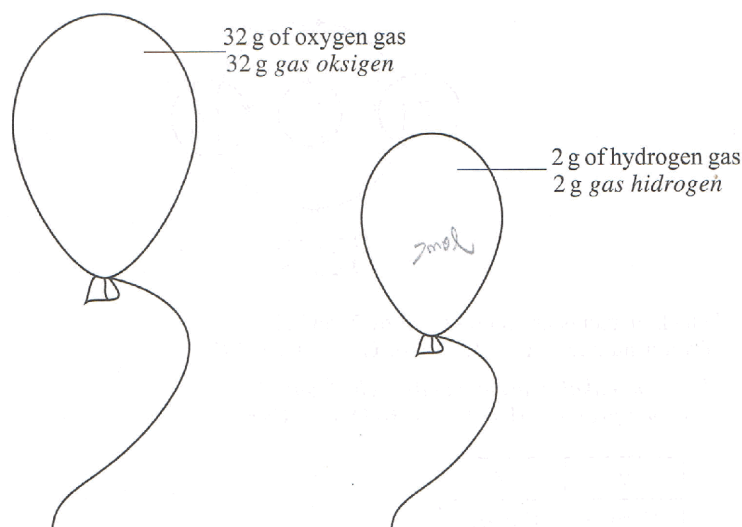


Diagram 4

Which statement is correct about the number of particles in oxygen gas?

[Relative atomic mass : H = 1, O = 16]

- A Same as in hydrogen gas
- B More than in hydrogen gas
- C Two times more than in hydrogen gas
- D 16 times more than in hydrogen gas

[MRSM04-38] How many oxygen atoms are combined together in 24 g of ozone, O₃?

[Relative atomic mass: O, 16; Avogadro's constant: $6 \times 10^{23} \text{ mol}^{-1}$]

- A 14×10^{23}
- B 9×10^{23}
- C 6×10^{23}
- D 3×10^{23}

[MRSM03-38] Which of the following contains the same number of atoms as in 0.32 g of oxygen? [Relative atomic mass: He=4; C=12; N=14; O=16; Cl=35.5]

- A 0.71 g chlorine gas
- B 0.44 g carbon dioxide gas
- C 0.14 g nitrogen gas
- D 0.04 g helium gas

[SPM09-44] Which substance contains the same number of atoms as in 12 g of carbon?

[Relative atomic mass: H=1, C=12, O=16, Mg=24, S=32]

- A 2 g of hydrogen
- B 12 g of magnesium
- C 22 g of carbon dioxide
- D 32 g of sulphur

[MRSM04-47] Which of the following quantities contains the same number of molecules as in 2.2 g of carbon dioxide?

[Relative atomic mass: H=1; C=12; O=16; 1 mole of gas occupies 24 dm³ at room condition ; Avogadro's constant: $6 \times 10^{23} \text{ mol}^{-1}$]

- I 0.8 g methane gas, CH₄
- II 1.4 g carbon monoxide, CO
- III 3.0×10^{23} molecules of nitrogen dioxide, NO₂
- IV 1.2 dm³ oxygen, O₂ at room condition.

- A I and III only
- B I, II and IV only
- C II, III and IV only
- D I, II, III and IV

[MRSM05-38] Which of the following amount of substances contains the same number of atom as in 0.69 g of sodium?

[Relative atomic mass: C=12, O=16, Na=23, Ca=40; Avogadro constant, $6 \times 10^{23} \text{ mol}^{-1}$]

- A 0.06 g hydrogen gas
- B 0.12 g calcium
- C 0.48 g oxygen gas
- D 0.69 g carbon

[SBPmidYear06-34] How many moles of atoms are there in 3.6 g of water, H₂O?

[Relative atomic mass: H=1, O=16]

- A 0.2
- B 0.4
- C 0.6
- D 0.8

[SBPdiag07-16] What is the number of atoms contained in 24 g of oxygen gas?

[Relative atomic mass of O=16, Avogadro Number = $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 1.5×10^{23}
- B 3.0×10^{23}
- C 4.52×10^{23}
- D 9.03×10^{23}

[SBPmidYear06-26] How many carbon dioxide molecules are there in 12 dm³ of carbon dioxide gas at room conditions?

[Molar volume = 24 dm³ mol⁻¹ at room conditions, Avogadro constant = $602 \times 10^{23} \text{ mol}^{-1}$]

- A 1.806×10^{24}
- B 3.01×10^{23}
- C 6.02×10^{23}
- D 6.02×10^{22}

[SBPmidYear07F4-34] If the Avogadro number is represented by the letter x, what is the number of hydrogen gas particles, H₂, with the molar volume of 24 dm³ mol⁻¹ at room temperature and pressure?

- A x
- B 2x
- C x - 2
- D $\frac{1}{2}$ x

[SPM03-47] Which of the following quantities of substances contain 6 X 10²³ molecules ?
[Relative atomic mass: H=1, C=12, O=16; Avogadro's Constant, 6 X 10²³ mol⁻¹]

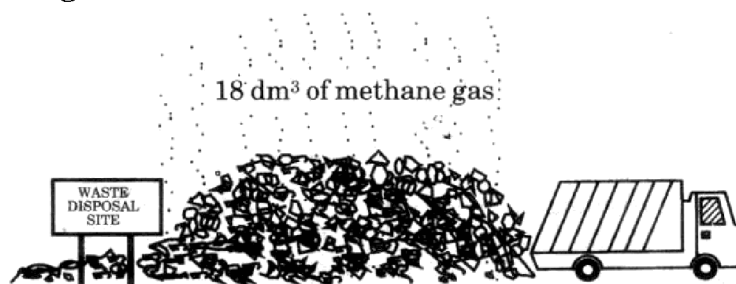
- I 1.8 g water
- II 1.0 g hydrogen gas
- III 3.2 g oxygen gas
- IV 4.4 g carbon dioxide

- A I and II only
- B III and IV only
- C I, III and IV only
- D I, II, III and IV

[MRSM06-42] Nitrogen exists as diatoms. What is the mass of one nitrogen molecule?
[Relative atomic mass: N=14; Avogadro constant = 6 x 10²³ mol⁻¹]

- A 2.1 x 10⁻²³ g
- B 2.3 x 10⁻²³ g
- C 4.7 x 10⁻²³ g
- D 28 x 10⁻²³ g

[SPM05-39] The picture shows a water disposal site. The activity of microorganisms in the waste produces methane gas.



What is the mass of methane gas produced?

[Relative atomic mass: H=1, C=12; 1 mole of gas occupies 24 dm³ at room temperature and pressure]

- A 12 g
- B 16 g
- C 21 g
- D 27 g

[MRSM03-47] Which of the following has the same volume as in 4.4 g carbon dioxide, CO_2 at standard temperature and pressure?

[Relative atomic mass: H=1; C=12; O=16; Ne=20; S=32; Cl=35.5]

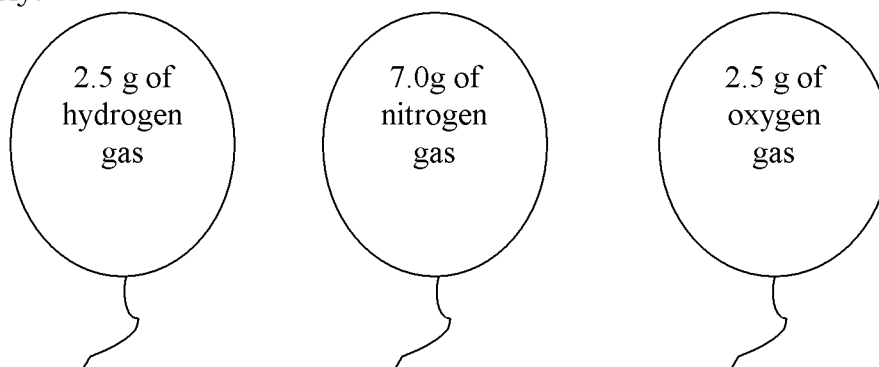
- I 0.2 g hydrogen gas, H_2
- II 2.0 g neon gas, Ne
- III 7.1 g chlorine gas, Cl_2
- IV 6.4 g sulphur dioxide gas, SO_2

- A I and III only
- B II and IV only
- C I, III and IV only
- D I, II, III and IV

[SPM06-38] If the Avogadro number is represented by the letter x , what is the number of hydrogen gas particles, H_2 , with the molar volume of $24 \text{ dm}^3 \text{ mol}^{-1}$ at room temperature and pressure?

- A x
- B $2x$
- C x^2
- D $1/2x$

[SBPdiag06-41] The diagram shows three balloons with hydrogen, nitrogen and oxygen gas respectively.



Arrange the gases in an ascending order of volume.

[Relative atomic mass: H=1, N=14, O=16 and 1 mol of gas occupies 24 dm^3 at room temperature and pressure]

- A Hydrogen, nitrogen, oxygen
- B Hydrogen, oxygen, nitrogen
- C Nitrogen, oxygen, hydrogen
- D Oxygen, nitrogen, hydrogen

[SBPmidYear07F4-33] Which of the following gases has the biggest volume at room temperature and pressure?

[Relative molecular mass: $\text{NH}_3=17$, $\text{N}_2=28$, $\text{CO}_2=44$ and $\text{SO}_2=64$]

- A 7.0 g nitrogen gas
- B 4.2 g ammonia gas
- C 16.0 g sulphur dioxide gas
- D 22.0 g carbon dioxide gas

[SPM09-48] How many molecules are there in 150 cm³ of carbon dioxide, CO₂ at room conditions?

[Avogadro's constant, 6.02 X 10²³ mol⁻¹; Molar volume of gas, 24 dm³ mol⁻¹ at room conditions]

- A 3.76 X 10²¹
- B 3.76 X 10²⁴
- C 9.63 X 10²²
- D 9.63 X 10²¹

[SBPTrial07-41] 34 g of ammonia consists of

[Relative molecular mass of ammonia = 17, Avogadro constant = 6.02 x 10²³ mol⁻¹]

- I 2 mole of nitrogen atoms
 - II 2 mole of ammonia molecules
 - III 1.204 X 10²⁴ molecules
 - IV 5 mole of hydrogen atoms
- A I and II only
 - B I, II and III only
 - C II, III and IV only
 - D I, II, III and IV only

[MRSM09-03] 1 mol of oxygen gas, O₂ and 1 mol of carbon dioxide gas, CO₂ have

- A same mass
- B same number of electrons
- C same number of atoms
- D same number of molecules

[SPM04-23] The table shows the relative atomic mass of elements Y and Z.

Element	Relative atomic mass
Y	80
Z	16

Which of the following is true about the atoms of elements Y and Z?

- A mass of one atom of Z is 16 g
- B the number of protons in atom Y is 80
- C 5 moles of Z have the same mass as 1 mole of Y
- D the density of one atom of Y is 5 times that of an atom of Z.

[SPM06-05] Table 1 shows two elements and their respective relative atomic mass. The letters used are not the actual symbol of the elements.

Element	Relative atomic mass
X	24
M	12

Table 1

Which of the following is true about the atoms of elements X and M?

- A The mass of 1 mol of X is twice the mass of 1 mol of M
 B 1 mol of X has the same mass as 1 mol of M
 C The mass of an atom of X is 24g and the mass of an atom of M is 12g
 D The number of mole in 12g of atom X is equal to the number of mole in 12g of atom M

[SBPTrial08-23] Table 1 shows the relative atomic mass of helium, carbon, sulphur and copper

Element	Helium	Carbon	Sulphur	Copper
Relative atomic mass	4	12	32	64

Table 1

Which of the following statements is **true**?

[Avogadro constant = $6.0 \times 10^{23} \text{ mol}^{-1}$]

- A Mass of one copper atom is 64 g
 B Mass of 1 mol of helium is 8 g
 C 32 g of sulphur contains 6.02×10^{23} sulphur atom
 D Mass of one sulphur atom is 32 times bigger than one carbon atom

[SBPdiag06-34] The table shows the relative atomic mass of elements M and N.

Element	Relative atomic mass
M	80
N	16

Which of the following statements is true?

- A The mass of an atom N is 16g
 B The number of protons of an atom M is 80
 C The mass of 5 mol of N is the same of the mass of 1 mol of M
 D Density of atom M is five times more than the density of atom N

[SBPdiag07-07] The table below shows the relative atomic mass for atoms of elements Q and S.

Element	Relative atomic mass
Q	20
S	40

Which of the following statements are correct?

- I 1 mol of atom S has twice the number of atoms in 1 mol of atom Q
 II One atom of S is 2 times heavier than one atom of Q
 III 2 g of Q contains the same the number of moles of atoms as in 8 g of S
 IV 40 g of S contains the same number of atoms as in 20 g of Q
- A II and III only
 B I, II and III only
 C II and IV only
 D I, II, III and IV

[SBPmidYear07F4-35] Table 4 shows the relative atomic mass of elements Y and Z.

Elements	Relative atomic mass
Y	80
Z	16

TABLE 4

Which of the following is true about the atoms of elements Y and Z?

- A The mass of one atom of Z is 16 g
- B The number of protons in atom Y is 80
- C 5 moles of Z have the same mass as 1 mole of Y
- D The density of one atom of Y is 5 times that of an atom of Z

[SBPmidYearF5-40] The relative atomic mass of metal Q is 7 and the relative atomic mass of the metal W is 56. Which of the following conclusions can be drawn from the above statement?

- I 1 mol of W has 8 times more atoms than 1 mol of Q
 - II 1 atom of W is 8 times heavier than 1 atom of Q
 - III 1 atom of W has the same number of protons with 8 atoms of Q
 - IV 56 g of W has the same number of atoms as in 7 g of Q
- A I and III only
 - B II and IV only
 - C I, II and III only
 - D I, II, III and IV

Empirical Formula

[MRS11-04] What is the meaning of empirical formula?

- A Formula that shows the actual number of atoms of each element in the compound
- B Formula that shows the simplest ratio of atoms of each element in the compound
- C Formula that shows how the atoms of elements are bonded together
- D Formula that shows the type of element in the compound

[MRS10-02] Which of the following is the empirical formula of $C_6H_{12}O_6$?

- A CHO
- B CH_2O
- C $C_2H_4O_2$
- D $C_6H_{12}O_6$

[SBPTrial07-14] The diagram below shows the molecular formula of glucose.



What is the empirical formula for glucose?

- A CH_2O
- B CH_2O_2
- C $C_2H_4O_2$
- D $C_6H_{12}O_6$

[MRSM09-02] $C_6H_{12}O_6$ is the molecular formula of glucose. What is its empirical formula?

- A $C_2H_2O_2$
- B CH_2O_2
- C $C_2H_4O_2$
- D CH_2O

[SPM07-03] Which compound has the empirical formula of CH_2O ?

- A $HCOOH$
- B CH_3COOH
- C CH_3COOCH_3
- D $HCOOC_2H_5$

[MRSM06-12] The diagram shows the molecular formula for glucose.



Which of the following substance has similar empirical formula as that of glucose?

	Substance	Molecular Formula
A	Ethanol	C_2H_6O
B	Ethan0l	C_2H_4O
C	Ethanoic acid	$C_2H_4O_2$
D	Methyl ethanoate	$C_3H_6O_2$

Calculation of Empirical Formula

[SBPtrial11-28] In an experiment, 24 g of element X react with 32 g sulphur to form a compound. What is the empirical formula of that compound?

[Relative atomic mass ; X = 6, S = 32]

- A XS
- B X_2S
- C X_2S_3
- D X_4S

[SPM09-38] A sample of iron oxide contains 5.6 g of iron and 2.4 g of oxygen. What is the empirical formula of this compound? [Relative atomic mass: O=16, Fe=56]

- A Fe_3O_4
- B Fe_2O_3
- C FeO_2
- D FeO

[SBPdiag07-32] 0.32 g of metal X combines with 0.36 g of non-metal Y. What is the empirical formula for this compound? [Relative atomic mass: X=64, Y=35.5]

- A XY
- B X_2Y
- C XY_2
- D XY_3

[MRSM04–39] Figure 13 shows an experiment to determine the empirical formula for an iron oxide.

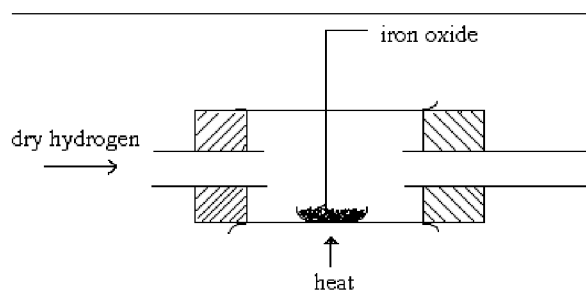


FIGURE 13

The experimental results are as follows:

Mass of an empty combustion tube	= 262.20 g
Mass of combustion tube + iron oxide	= 264.92 g
Mass of combustion tube + iron that is produced	= 264.44 g

What is the empirical formula for this iron oxide?
[Relative atomic mass: Fe=56; O=16]

- A FeO
- B Fe₂O₃
- C Fe₃O₄
- D Fe₂O₅

[SPM04-41] The table shows the mass of elements M and O in an oxide, and the relative atomic mass of elements M and O.

Element	M	O
Mass/g	5.6	2.4
Relative atomic mass	56	16

The empirical formula for oxide of M is

- A M₂O₃
- B M₂O
- C MO₂
- D MO

[SBPTrial09-15] Table 1 shows the mass of elements M and O in an oxide of M, and the relative atomic mass of elements M and O

Element	M	O
Mass/ g	1.62	1.44
Relative atomic mass	27	16

Table 1

Which of the following formulae is the empirical formula for the oxide of M?

- A MO
- B MO₂
- C M₂O
- D M₂O₃

[SBPTrial10-31] 11 g oxide M reduced to form 6.2 g metal M. Empirical formulae of oxide M is.... [Relative atomic mass; O=16, M=31]

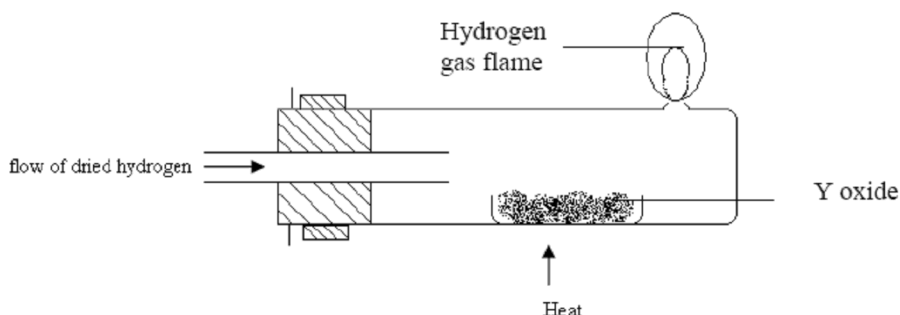
- A MO
- B M_2O
- C M_3O_2
- D M_2O_3

[SPM03-43] Stainless steel used to make surgical scalpels contains 71.5% iron, 18.0 % chromium, 8.0 % nickel, and 2.5 % other elements.

If the mass of surgical scalpels is 60.0 g, what is the mass of iron in it?

- A 4.8 g
- B 10.8 g
- C 42.9 g
- D 71.5 g

[MRSM05-03] The diagram shows the method used to determine the empirical formula of a metal oxide Y.



Which of the following oxide is possible for metal oxide Y?

- A Zinc oxide
- B Sodium oxide
- C Magnesium oxide
- D Copper(II) oxide

[SPM03-02] Diagram 2 shows the set up of the apparatus to determine the empirical formula of a metal oxide

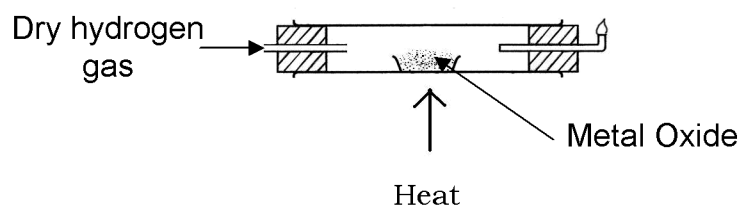
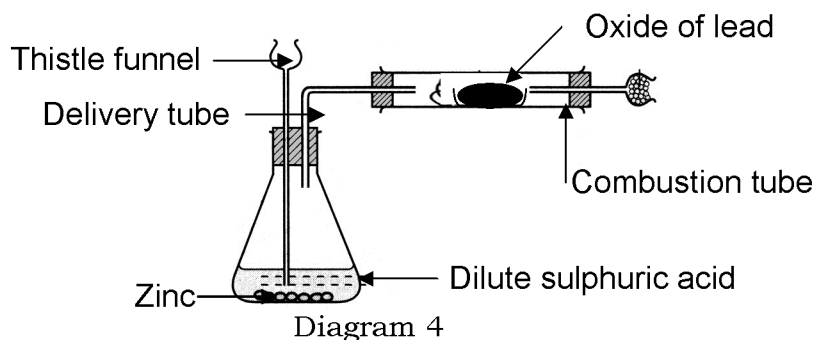


Diagram 2

Which of the following metal oxide is suitable to be used in Diagram 2?

- A Zinc oxide
- B Magnesium oxide
- C Aluminium oxide
- D copper (II) oxide

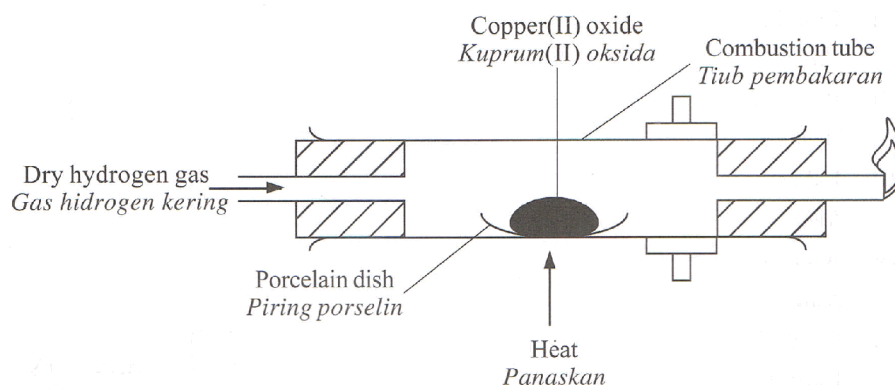
[SPM03-15] Diagram 4 shows the set up of apparatus in an experiment to determine the empirical formula of an oxide of lead.



Which of the following is **not** correct in the set up of apparatus for this experiment?

- I No Bunsen burner
 - II Fixing of the cork
 - III Position of the thistle funnel
 - IV Position of the delivery tube
- A I and III only
 - B II and IV only
 - C I, II and III only
 - D I, III and IV only

[SPM11-07] Diagram 1 shows the apparatus set-up to determine the empirical formula of copper(II) oxide.



The dry hydrogen gas must be flowed through the apparatus for several minutes before heating the copper(II) oxide. What is the reason for this action to be taken?

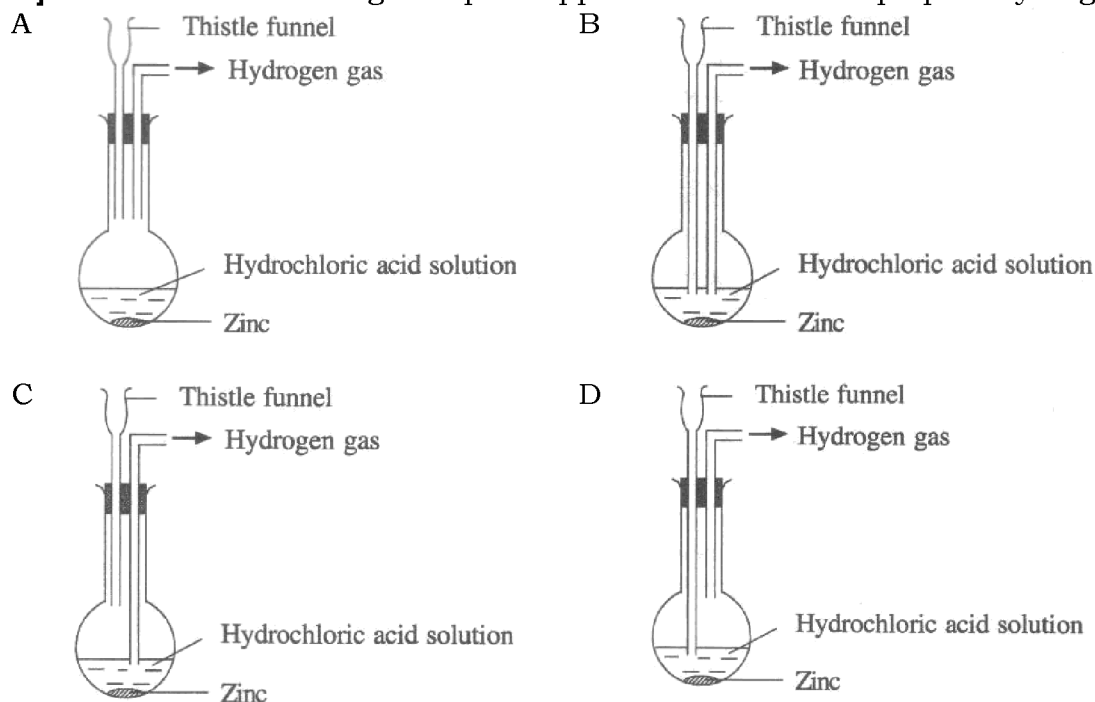
- A To ensure all the copper(II) oxide has changed into copper
- B To ensure all air has been removed so that explosion can be prevented
- C To prevent copper from reacting with air to form copper(II) oxide
- D To prevent the water from flowing towards the hot porcelain dish and cracks the combustion tube

[SPM06-07] The empirical formula of copper oxide is determined by its reaction with hydrogen. The heating, cooling and weighing steps are repeated several times but a constant mass of the product is still not obtained.

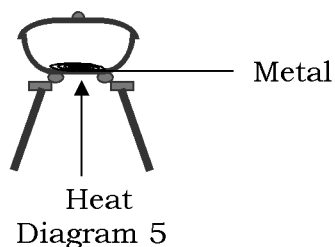
Which of the following can be done to get a constant mass of the product?

- A During heating, dry hydrogen gas is passed through
 B During cooling, dry hydrogen gas is passed through
 C During weighing, the combustion tube must be stoppered
 D During heating, excess hydrogen gas is burnt

[SPM06-06] Which of the following set ups of apparatus is correct to prepare hydrogen gas?



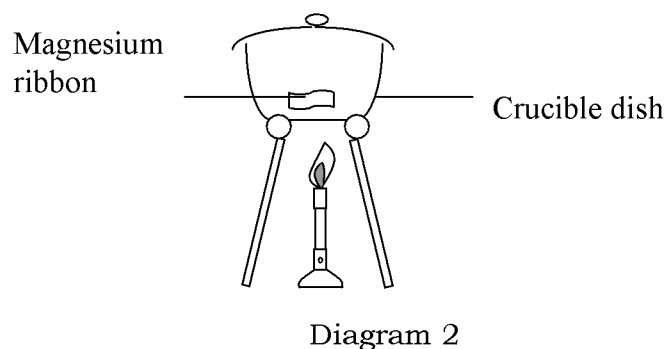
[SBPTrial08-17] Diagram 5 shows the set up of apparatus to determine the empirical formula for metal oxide.



Which of the following metals is most suitable to be used in the diagram?

- A Lead
 B Silver
 C Copper
 D Magnesium

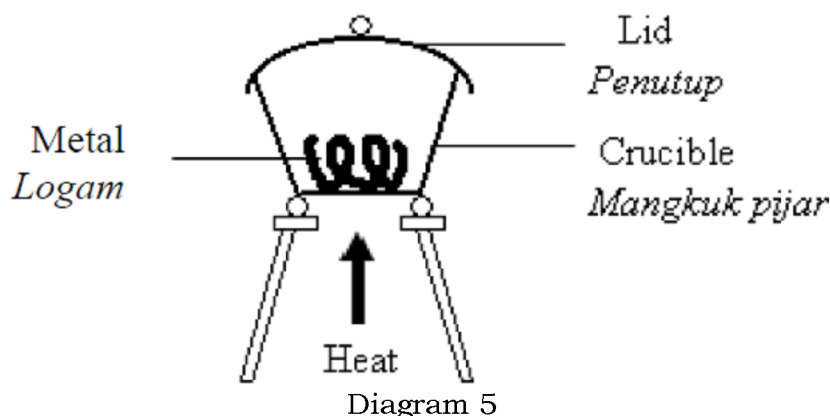
[SBPTrial09-03] Diagram 2 shows the set-up of apparatus to determine the empirical formula of magnesium oxide.



Which of the following statements is true for the lifting and closing of the lid quickly and occasionally during heating?

- A To avoid the pressure in the crucible dish
- B To avoid the crucible dish from cracking
- C To avoid the white fumes from escaping
- D To avoid water vapour from entering the crucible dish

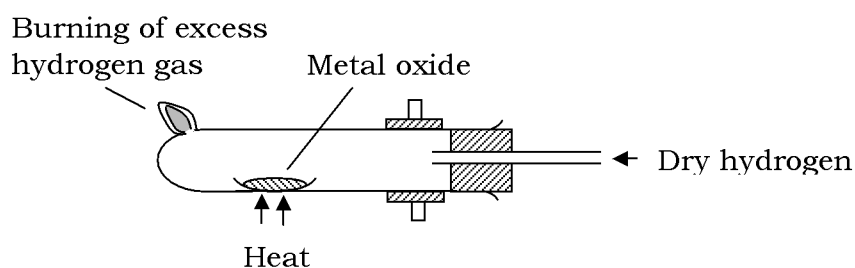
[SBPtrial11-15] Diagram 5 shows the set-up of apparatus to determine the empirical formula of a metal oxide.



Which of the following metal is suitable to be used in the experiment?

- A Lead
- B Copper
- C Aluminium
- D Stanum

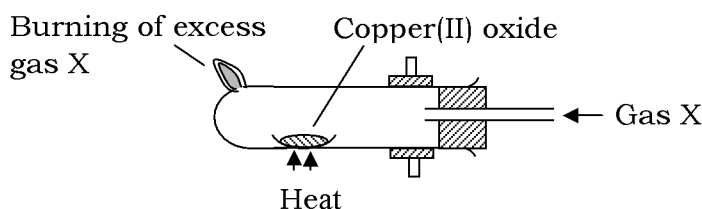
[SBPdiag06-11] The diagram shows the set up of the apparatus for an experiment to determine the empirical formula of a metal oxide.



Which of the following information is not needed to determine the empirical formula of the metal oxide?

- A Mass of the metal oxide
- B Mass of the hydrogen
- C Mass of the oxygen
- D Mass of the metal

[SBPmidYear06-10] The diagram shows the set up of the apparatus for an experiment.



Copper(II) oxide can react with gas X to produce copper. What is gas X?

- A Oxygen
- B Nitrogen
- C Hydrogen
- D Carbon dioxide

Determine RAM

[MRSM03-39] 5.4 g metal M reacts with oxygen gas to produce 10.2 g M oxide with the formula M_2O_3 . What is the relative atomic mass for metal M? [Relative atomic mass of O=16]

- A 27
- B 34
- C 51
- D 54

[SPM04-38] A compound with formula X_2CO_3 has a relative formula mass of 138. What is the relative atomic mass of X? [Relative atomic mass: C=12 and O=16]

- A 39
- B 69
- C 78
- D 110

[SPM05-40] 5 g of element X reacted with 8 g of element Y to form a compound with the formula XY_2 . What is the relative atomic mass of element X? [Relative atomic mass of Y=80]

- A 25
- B 40
- C 50
- D 100

[SBPTrial09-29] 10 g of metal oxide with a formula of MO can be completely reduced to 8 g of metal M. What is the relative atomic mass of M? [Relative atomic mass of O=16]

- A 32
- B 40
- C 64
- D 80

Molecular Formula

[SBPmidYearF508-41] 3.0 g of carbon reacts with 0.5 g of hydrogen gas to form compound X. What is the molecular formula of compound X?
[Relative atomic mass: C,12; H,1, Relative molecular mass of compound X is 42]

- A CH_2
- B C_2H_4
- C C_2H_6
- D C_3H_6

[SBPmidYear06-32] A compound consists of 85 % of carbon and 15 % of hydrogen. The relative molecular mass of the compound is 28. Find the molecular formula of the compound. [Relative atomic mass of H=1, C=12]

- A C_2H_4
- B C_2H_6
- C C_3H_6
- D C_3H_8

[SBPdiag08-42] A hydrocarbon has the empirical formula of CH_3 with a molar mass of 30 g mol^{-1} . Which of the following is the molecular formula of the hydrocarbon? [Relative atomic mass: H=1, C=12]

- A CH_3
- B C_2H_6
- C C_3H_9
- D C_4H_{12}

[SPM09-37] The relative molecular mass of $M_2(SO_4)_3$ is 342. What is the relative atomic mass of element M? [Relative atomic mass: O=16, S=32]

- A 27
- B 54
- C 118
- D 123

[SBPmidYear07F4-23] The relative molecular mass of a compound with formula $Na_2X_2 O_3$ is 158. What is the relative atomic mass of element X? [Relative atomic mass: O=16 and Na=23]

- A 120
- B 90
- C 64
- D 32

[SBPmidYearF5-36] A compound with formula M_2CO_3 has a relative formula mass of 138. What is the relative atomic mass of M ? [Relative atomic mass: C=12, O=16]

- A 39
- B 69
- C 78
- D 110

Calculation of Percentage

[SPM10-46]

46. Ammonium sulphate is used as a fertilizer. What is the percentage by mass of nitrogen in ammonium sulphate? [Relative atomic mass : H =1; N =14; O = 16; S = 32]

- A 10.6 %
- B 12.3 %
- C 13.3 %
- D 21.2 %

[MRSM07-39] Ammonium sulphate, $(\text{NH}_4)_2\text{SO}_4$ is a fertilizer. What is the percentage of nitrogen in a molecule of the compound? [Relative atomic mass: H=1; N=14; O=16 ; S=32]

- A 23.7%
- B 21.9 %
- C 21.2 %
- D 10.6 %

[SBPmidYearF5-28] What is the percentage by mass of nitrogen content in urea, $\text{CO}(\text{NH}_2)_2$? [Relative atomic mass: C=12, N=14, H=1, O=16]

- A 23.3 %
- B 31.8 %
- C 46.7 %
- D 63.6 %

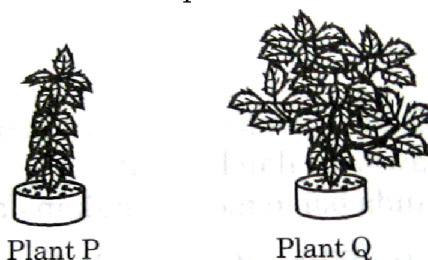
[SBPTrial08-46] Ammonium sulphate, $(\text{NH}_4)_2\text{SO}_4$ is an example of a fertilizer. Calculate the percentage of nitrogen in 1 mole of ammonium sulphate. [Relative atomic mass: N=14, H=1, S=32, O=16]

- A 12.12 %
- B 21.21 %
- C 23.23 %
- D 31.31 %

[SBPTrial09-37] Which of the following fertilizers is the most suitable to increase soil fertility? [Relative molecular mass: $\text{NaNO}_3=85$, $\text{NH}_4\text{NO}_3=80$, $(\text{NH}_4)_2\text{SO}_4=132$, $(\text{NH}_4)_3\text{PO}_4=149$, Relative atomic mass: N=14]

- A NaNO_3
- B NH_4NO_3
- C $(\text{NH}_4)_2\text{SO}_4$
- D $(\text{NH}_4)_3\text{PO}_4$

[SPM05-50] The picture shows two hibiscus plants in soil with different amount of fertility.



Plant P

Plant Q

Which of the following combinations of substances can be used to increase the fertility of the soil of plant P?

	I	II	III	IV
A	$(\text{NH}_4)_2\text{SO}_4$	NH_4NO_3	CH_3COONa	PbCl_2
B	PbSO_4	BaSO_4	CH_3COONa	PbCl_2
C	CH_3COONa	PbCl_2	NaNO_3	K_2SO_4
D	$(\text{NH}_4)_2\text{SO}_4$	NH_4NO_3	NaNO_3	K_2SO_4

[SPM10-03] The proton number of atom R is 14 and its relative atomic mass is 28. Which statement is correct about R?

- A The mass of 1 atom R is 28 g
- B The molar mass of R is 28 g mol⁻¹
- C 14 g of R contains 6.0 x 10²³ atoms
- D Atom R has 14 protons, 14 electron and 28 neutrons

Chemical Formula

[MRSM07-02] Which of the following formula represents a compound containing three atoms?

- A HNO₃
- B H₂O
- C LiF
- D ZnSO₄

[SPM11-33] Element M is in the same group as magnesium in the Periodic Table. It reacts with oxygen gas to form a compound with the formula MO. What is the formula of the fluoride of element M? [Proton number : F = 9, Mg = 12]

- A MF
- B MF₂
- C M₂F
- D M₂F₂

[SBPtrial11-02] Given the formulae for aluminium ion is Al³⁺ and sulphate ion is SO₄²⁻. Choose the correct chemical formula of aluminium sulphate.

- A Al(SO₄)₃
- B Al₂(SO₄)₃
- C Al₃(SO₄)₂
- D AlSO₄

[MRSM07-37] Metal M forms a chloride compound with the formula MCl₃. Given the formula of chromate (IV) ions is CrO₄²⁻, then the formula of M chromate is

- A MCrO₄
- B M₂CrO₄
- C M(CrO₄)₃
- D M₂(CrO₄)₃

[SPM05-25] The formula for a sulphate ion is SO₄²⁻ and for a nitrate is NO₃⁻. If the formula of the sulphate salts of M is MSO₄, what is the formula of the nitrate salt of M?

- A MNO₃
- B M₂NO₃
- C M(NO₃)₂
- D M(NO₃)₃

[SPM08-36] Which compound has the correct formula?

	Compound	Formula
A	Barium nitrate	Ba(NO ₃) ₂
B	Lead (II) oxide	PbO ₂
C	Copper (II) oxide	Cu ₂ O
D	Silver carbonate	AgCO ₃

[SBPTrial07-02] Which of the following is a chemical formula of ammonium sulphate?

- A NH₄SO₄
- B (NH₄)₂SO₄
- C (NH₃)₂SO₄
- D (NH₄)₃(SO₄)₂

[SBPdiag06-26] The diagram shows the formula of the sulphate of metal L.



What is the formula of the nitrate of metal L?

- A L(NO₃)₃
- B L(NO₃)₂
- C L₂NO₃
- D LNO₃

[SBPmidYear06-11] Magnesium oxide is an ionic compound consists of ions Mg²⁺ and O²⁻. Which of the following is the chemical formula of magnesium oxide?

- A Mg₂O₂
- B MgO₂
- C MgO
- D Mg₂O

[SBPdiag07-25] The formula for a carbonate ion is CO₃²⁻ and for nitrate ion is NO₃⁻. If the formula of the carbonate salt of X is XCO₃, what is the formula of the nitrate salt of X?

- A XNO₃
- B X₂NO₃
- C X(NO₃)₂
- D X(NO₃)₃

[SBPmidYear07F4-24] The bromide of metal M has the formula MBr₃ and sodium phosphate has the formula Na₃PO₄. What is the formula of the phosphate of metal M?

- A MPO₄
- B M₂PO₄
- C M₃PO₄
- D M(PO₄)₃

[SBPmidYear07F4-37] An element M has two oxidation numbers, +1 and +2. Which of the following compounds formed by M is **incorrect**?

- A M_2O
- B $M(NO_3)_3$
- C MSO_4
- D MCO_3

[SBPdiag08-02] Which of the following is the correct formula for barium hydroxide?

- A $BaOH$
- B Ba_2OH
- C $Ba(OH)_2$
- D $BaOH_2$

[SBPdiag08-10] The formula of a substance is written as $FeSO_4$. What is the name of the compound according to the IUPAC system?

- A Iron sulphate
- B Iron(II) sulphate
- C Iron(III) sulphate
- D Iron(II) sulphite

[SBPdiag08-18] The ion of a newly discovered metal M has the symbol M^{3+} . What will be the formula of its chloride?

- A MCl
- B M_2Cl_3
- C MCl_3
- D M_3Cl

[MRSM07-24] Diagram 12 shows a model of a molecule containing carbon, hydrogen and oxygen.

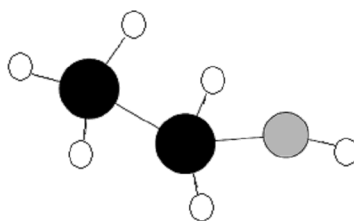


Diagram 12

How many atoms of each element are in the molecule?

	Carbon	Hydrogen	Oxygen
A	1	6	2
B	2	5	1
C	2	6	1
D	6	2	1

[MRSM11-03] Diagram 2 shows the chemical formula of a substance.



Diagram 2

What is the name of the substance?

- A Phosphorus pentachloride
- B Phosphorus trichloride
- C Phosphorus chlorate
- D Phosphorus chloride

[SBPmidYear06-05] Which of the following substance is paired correctly with its chemical formula?

	Substance	Chemical Formulae
A	Potassium oxide	KO
B	Sodium hydroxide	NaOH
C	Copper(II) sulphate	Cu_2SO_4
D	Lead(II) chloride	PbCl

[SBPdiag07-11] The chemical formula for magnesium chloride is as follows:



Which of the following information can be obtained from the formula?

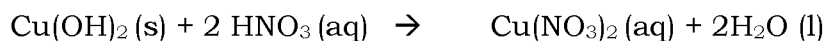
- I The mol ratio of magnesium to chlorine is 1: 2
 - II The compound is made up of magnesium ions and chloride ions
 - III The relative formula mass of the compound is the total mass of two magnesium atoms and 1 chlorine atom
 - IV One formula unit of this compound contains two ions only
- A I and II only
 - B I and III only
 - C II and III only
 - D II, III and IV only

[SBPmidYearF5-27] The chemical formula for glucose is $\text{C}_6\text{H}_{12}\text{O}_6$. This shows that
[Use the information relative atomic mass for H =1, C=12 and O=16, Avogadro Constant = $6.02 \times 10^{23} \text{ mol}^{-1}$]

- I the empirical formula for glucose is CH_2O
 - II each glucose molecule is made up of 6 carbon atoms, 12 hydrogen atoms and 6 oxygen atoms.
 - III 1 mol of glucose contains a total of 144×10^{23} atoms
 - IV One glucose molecule has a mass of 180 times higher than the mass of 1 hydrogen atom
- A I and II only
 - B I, III and IV only
 - C II, III and IV only
 - D I, II, III and IV

Chemical Equation

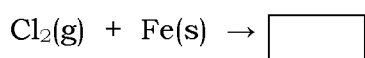
[SPM10-04] The following equation represents a reaction.



What are the reactants in this equations?

- A Copper(II) nitrate and water
- B Copper(II) nitrate and nitric acid
- C Copper(II) hydroxide and nitric acid
- D Copper(II) hydroxide and copper(II) nitrate

[SBPTrial09-17] The chemical equation below shows a reaction between chlorine and iron. Which of the following is the formula of the product?

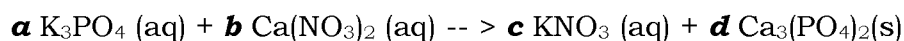


- A FeO
- B Fe₂O₃
- C FeCl₂
- D FeCl₃

[SPM09-02] Which chemical equation is correctly balanced?

- A $\text{K} + \text{O}_2 \rightarrow \text{K}_2\text{O}$
- B $\text{K} + \text{Cl}_2 \rightarrow \text{KCl}$
- C $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
- D $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$

[MRSM05-40] The equation shows a precipitation reaction of potassium phosphate



The corresponding values of **a** , **b** , **c** , and **d** are

- A 1 , 6 , 3 , 2
- B 2 , 3 , 6 , 1
- C 6 , 2 , 1 , 3
- D 3 , 1 , 2 , 6

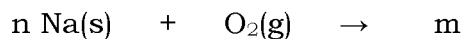
[SBPdiag06-18]The chemical equation below shows the reaction between ammonia and copper (II) oxide.



What are the values of *a* , *b* , *c* , *d* and *e*?

- A 2, 2, 1, 3, 3
- B 2, 3, 1, 3, 3
- C 2, 3, 1, 3, 1
- D 2, 3, 2, 3, 3

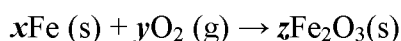
[SBPTrial09-42] The following chemical equation shows the reaction between sodium and oxygen.



What are the values of n , m and the formula in the box?

	n	m	Formula
A	4	2	Na ₂ O
B	2	2	Na ₂ O
C	2	2	NaO ₂
D	2	4	NaO

[SBPmidYear06-18] The equation below represents a chemical reaction.



What are the values of x , y and z ?

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

[MRSM07-24] Diagram 8 shows the apparatus set-up for the decomposition of calcium carbonate.

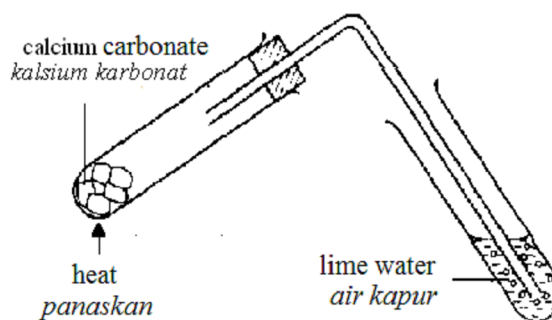


Diagram 8

Which of the following equations represents the reaction that occurs in the test tube containing lime water?

- A $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 B $\text{Ca} + 2 \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$
 C $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
 D $\text{Ca}^{2+} + 2 \text{OH}^- \rightarrow \text{Ca(OH)}_2$

[SBPTrial10-26] The following equation shows the reaction between copper(II) carbonate and hydrochloric acid.



7.0 g copper(II) carbonate is added to 50 cm³ of 1.0 mol dm⁻³ hydrochloric acid. What is the mass of copper(II) carbonate left at the end of the reaction?

[Relative atomic mass; Cu=64, C=12, O=16]

- A 0.8 g
 B 3.1 g
 C 3.9 g
 D 6.2 g

[SBPmidYearF508-42] Magnesium ribbon reacts with element Q from group 17 in Periodic Table. Which of the following chemical equations is correct?

- A $\text{Mg} + \text{Q} \rightarrow \text{MgQ}$
 B $\text{Mg} + \text{Q}_2 \rightarrow \text{MgQ}_2$
 C $2\text{Mg} + \text{Q}_2 \rightarrow 2\text{MgQ}$
 D $\text{Mg} + 2\text{Q} \rightarrow \text{MgQ}_2$

Calculation Evolving of Chemical Equation

[MRSM11-37] Aluminium carbonate decomposes when heated strongly to produce aluminium oxide and carbon dioxide.



What is the maximum volume of the gas that can be obtained at room temperature when 23.4 g of aluminium carbonate is heated?

[Molar mass of $\text{Al}_2(\text{CO}_3)_3 = 234 \text{ g mol}^{-1}$; Molar volume of gas at room temperature = $24 \text{ dm}^3 \text{ mol}^{-1}$]

- A 2.4 dm^3
 B 4.8 dm^3
 C 7.2 dm^3
 D 8.0 dm^3

[SPM11-36] When copper(II) carbonate, CuCO_3 is heated, the gas released turns the lime water chalky. What is the volume of gas released when 0.62 g of copper(II) carbonate is heated at room conditions?

[Relative atomic mass : C = 12, O = 16, Cu = 64; Molar volume of gas = $24 \text{ dm}^3 \text{ mol}^{-1}$ at room conditions]

- A 5 cm^3
 B 120 cm^3
 C 240 cm^3
 D 360 cm^3

[SPM10-08] The following equation shows the decomposition of hydrogen peroxide, H_2O_2 .



What is the volume of oxygen gas, O_2 produced from the decomposition of 500 cm^3 of 2 mol dm^{-3} hydrogen peroxide at standard temperature and pressure (STP)?

- A 11.2 dm^3
 B 22.4 dm^3
 C 33.6 dm^3
 D 44.8 dm^3

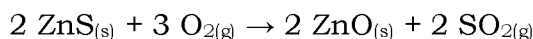
[MRSM10-44] The following chemical equation represents the complete combustion of propane.



What is the volume of oxygen gas used if 5.5 g of propane is completely burnt in air?
[Relative atomic mass: H = 1, C = 12, O = 16; Molar volume of gas = 24 dm³mol⁻¹ at room conditions]

- A 30.0 dm³
- B 15.0 dm³
- C 9.0 dm³
- D 3.0 dm³

[SBPTrial10-50] Chemical equation show reaction zinc sulfide with oxygen.



What is volume of oxygen is needed for complete reaction with 38.8g zink sulfide at room temperature?

[Relative formula mass ZnS=97, 1 mol gas occupied 24 dm³ at room temperature]

- A 4.8 dm³
- B 9.6 dm³
- C 14.4 dm³
- D 28.8 dm³

[SPM10-07] An oxide of element X has the empirical formula of X₂O₃. 2.24 g of element X reacts completely with 0.96 g of oxygen. What is the relative atomic mass of X?

[RAM : O = 16]

- A 112
- B 56
- C 25
- D 17

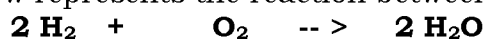
[MRSM03-40] When copper(II) nitrate is heated, it decomposed according to the following reaction:



Which of the following will be produced when 1.88 g solid copper(II) nitrate is strongly heated?
[Relative atomic mass: C=12; N=14; O=16; Cu=64; Molar volume of gas: 24 dm³ at room conditions]

- A 0.01 mol oxygen
- B 1.6 g copper (II) oxide
- C 0.03 mol gases evolved
- D 480 cm³ nitrogen dioxide gas

[MRSM04-37] The equation below represents the reaction between hydrogen and oxygen gas to form water.



Calculate the volume of oxygen required at room condition when 0.24 dm³ hydrogen gas reacts completely. [1 mol of gas occupies 24 dm³ at room condition]

- A 0.12 dm³
 B 0.24 dm³
 C 0.48 dm³
 D 2.40 dm³

[MRS06-48] Copper(II) carbonate decomposes when heated strongly as represented by the following equation.



What is the volume of carbon dioxide gas released when 0.62 g copper(II) carbonate is heated? [Relative atomic mass of Cu=64, C=12, O=16 and 1 mol of gas occupies 24 dm³ at room temperature and pressure]

- A 120 cm³
 B 240 cm³
 C 480 cm³
 D 640 cm³

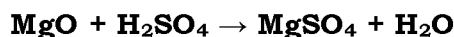
[MRS07-50] When zinc nitrate is heated strongly, it decomposes according to the equation



Which of the following will be produced when 18.9 g of zinc nitrate is heated? [Molar mass Zn(NO₃)₂ = 189 gmol⁻¹, molar mass zinc oxide = 81 gmol⁻¹ and 1 mol of gas occupies a volume of 24 dm³ at room temperature and pressure]

- A 4.8 dm³ nitrogen dioxide gas
 B 0.04 mol of oxygen gas
 C 7.1 g zinc oxide
 D 2.4 dm³ oxygen gas

[MRS09-37] The following chemical equation represents a reaction between magnesium oxide and sulphuric acid.



What is the mass of magnesium sulphate formed when 2.0 g of magnesium oxide powder is reacted with excess sulphuric acid? (Molar mass: MgO=40; MgSO₄=120)

- A 3.6 g
 B 6.0 g
 C 9.6 g
 D 12.0 g

[SPM03-37] The equation below represents the reaction to extract aluminium from aluminium oxide



What is the mass of aluminium that can be extracted from 102 g of aluminium oxide? [Relative atomic mass: O=6; Al=27]

- A 13.5 g
 B 27.0 g
 C 54.0 g
 D 108.0 g



The equation above shows the action of heat on the carbonate salt of metal X. how many moles of XCO_3 are needed to produce 4.0 g of oxide X?

[Relative atomic mass: C=12, O=16, X=64]

- A 0.03 g
- B 0.05 g
- C 0.08 g
- D 0.09 g

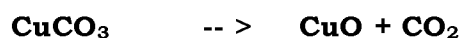
[SPM07-23] The following equation represents the reaction between aluminium and oxygen.



Which of the following statements is correct?

- A 4 mol of aluminium atoms react with 3 mol of oxygen atoms
- B 4 mol of aluminium atoms react with 3 mol of oxygen molecules
- C 4 mol of aluminium atoms react with 3 mol of oxygen atoms producing 2 mol of aluminium oxide
- D 4 mol of aluminium atoms react with 6 mol of oxygen molecules producing 2 mol of aluminium oxide

[SPM07-37] The following equation shows the decomposition reaction of copper (II) carbonate when heated at room temperature and pressure.

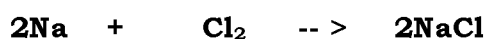


Which of the following is not true when 1 mol of copper (II) carbonate is decomposed?

[Relative atomic mass: C= 12, O= 16, Cu= 64 and 1 mol of gas occupies the volume of 24 dm³ at room temperature and pressure.]

- A 1 mol of copper (II) oxide is formed
- B 1 molecule of carbon (II) dioxide gas is given off
- C 80 g of copper (II) oxide is formed
- D 24 dm³ of carbon dioxide gas is given off

[SPM08-42] Sodium reacts with chlorine to form sodium chloride



What is the mass of sodium chloride formed when 2.30g of sodium reacts with excess chlorine? [Relative atomic mass: Na=23, Cl=35.5]

- A 2.93g
- B 5.85g
- C 9.40g
- D 11.70g

[SBPTrial08-45] The following equation shows the complete combustion of propene gas.



Which of the following statements are true when 1 mol of propene gas is burnt completely?

[Relative molecular mass: $C_3H_6 = 42$, $O_2 = 32$, $CO_2 = 44$, $H_2O = 18$, Molar volume of gas is $22.4 \text{ dm}^3 \text{ mol}^{-1}$ at S.T.P.]

- I Complete combustion of 0.1 mol of propene produces 5.4 g of water
II Complete combustion of 1 mol of propene gas produces 2 mol of water
III Complete combustion of 4.2 g of propene requires 14.4 g of oxygen.
IV Complete combustion of 0.1 mol of propene produces 6.72 dm^3 carbon dioxide gas at STP
- A I and II only
B I and IV only
C II and IV only
D I, III and IV

[SBPTrial09-39] The following equation shows the decomposition of carbonate M when heated strongly.

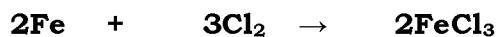


What is the mass of MCO_3 needed to produce 8.0 g of MO?

[Relative atomic mass: C = 12, O = 16, M = 64]

- A 3.7 g
B 6.2 g
C 8.0 g
D 12.4 g

[SPM09-40] The following chemical equation shows the reaction between iron and chlorine.

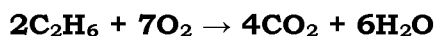


1.12 g of iron burns completely in chlorine. What is the mass of the product?

[Relative atomic mass: Cl = 35.5, Fe = 56]

- A 0.38 g
B 3.25 g
C 4.88 g
D 6.50 g

[SPM09-46] The following chemical equation shows the complete combustion of ethane gas.



What is the volume of ethane needed to produce 2.2 g of carbon dioxide at standard temperature and pressure?

[Molar mass of $CO_2 = 44 \text{ g mol}^{-1}$, molar volume of gas at standard temperature and pressure = $22.4 \text{ dm}^3 \text{ mol}^{-1}$]

- A 0.05 dm^3
B 0.10 dm^3
C 0.56 dm^3
D 1.12 dm^3

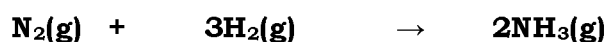
[SBPdiag06-47] Propene, C₃H₆ burns in oxygen as follows.



What is the number of carbon dioxide molecules produced from a complete burning of 21g of propene? [Relative atomic mass of H=1, C=12, O=16, Avogadro constant = $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 3.01×10^{23}
- B 6.02×10^{23}
- C 9.03×10^{23}
- D 12.04×10^{23}

[SBPmidYear06-17] The equation shows the reaction of nitrogen, N₂ and hydrogen, H₂ to form ammonia, NH₃.



Based on the equation, how many moles of ammonia is formed if 2 moles of nitrogen react with 6 moles of hydrogen?

- A 2
- B 4
- C 5
- D 6

[SBPmidYear06-37] The equation shows the reaction between potassium and oxygen.



What is the mass of potassium needed to produce 23.5 g of potassium oxide? [Relative atomic mass of K= 39; Relative formula mass of K₂O=94]

- A 9.75 g
- B 19.50 g
- C 29.50 g
- D 39.00 g

[SBPmidYear06-39] The equation shows a decomposition reaction of copper(II) nitrate



What is the number of oxygen molecules is produced when 9.4 g copper(II) nitrate is heated. [Given that relative formula mass of Cu(NO₃)₂=188; Avogadro constant = $6.02 \times 10^{23} \text{ mol}^{-1}$]

- A 1.505×10^{22}
- B 3.010×10^{22}
- C 1.505×10^{23}
- D 3.010×10^{23}

[SBPdiag07-20] The equation below shows the action of heat on copper(II) carbonate, CuCO₃.



How many moles of CuCO₃ are needed to produce 6.0 g of copper(II) oxide, CuO? [Relative atomic mass: C=12, O=16, Cu=64]

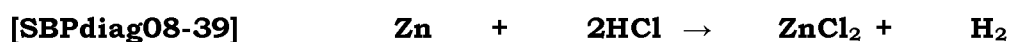
- A 0.035
 B 0.050
 C 0.075
 D 0.080

[SBPdiag08-31] The following equation represents the reaction between copper(II) oxide and nitric acid.



Calculate the mass of copper(II) nitrate formed when 6.4g of copper (II) oxide powder reacts with excess nitric acid. [Relative atomic mass: Cu=64; N=14; O=16]

- A 4.96g
 B 5.04g
 C 7.52g
 D 15.04g



Based on the equation above, calculate the volume of hydrogen gas released at room conditions when 1.3 g of zinc powder reacts with excess hydrochloric acid.

[Molar volume: 24 dm³ mol⁻¹ at room conditions, Relative atomic mass: H=1; Cl=35.5; Zn, 65]

- A 120 cm³
 B 240 cm³
 C 360 cm³
 D 480 cm³

[SBPmidYearF5-44] The equation below represents the reaction to extract aluminium from aluminium oxide.

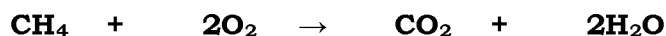


What is the mass of aluminium that can be extracted from 51 g of aluminium oxide?

[Relative atomic mass: Al=27, O=16]

- A 6.75 g
 B 13.5 g
 C 27.0 g
 D 54.0 g

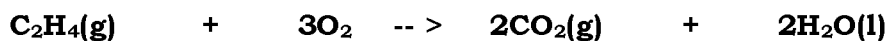
[SBPmidYearF5-47] The combustion of methane is as follows:



If 100 cm³ of methane is burnt in excess air, what is the volume of carbon dioxide gas given off at room conditions? [1 mol of gas occupies 24 dm³ at room conditions]

- A 100 cm³
 B 150 cm³
 C 200 cm³
 D 300 cm³

[SBPmidYearF508-23] The chemical equation shows the burning process of ethene in excess air.



What is the maximum volume of carbon dioxide gas evolved when 0.5 mole of ethene burns completely? [1 mole of gas occupied 24 dm³ at room temperature and pressure]

- A 12 dm³
- B 24 dm³
- C 36 dm³
- D 48 dm³

[SBPmidYearF508-33] The equation shows the reaction of the extraction of iron from iron(III) oxide.



What is the mass of iron which can be extracted from 10.0 g of iron(III) oxide? [Relative atomic mass: Fe=56; O=16]

- A 3.5 g
- B 4.5 g
- C 6.0 g
- D 7.0 g

[SPM05-37] A hydrocarbon compound is burnt completely in air to form 17.6 g of carbon dioxide gas and 7.2 g of water. What is the molecular formula of the hydrocarbon compound? [Relative atomic mass: C=12, H=1, O=16]

- A C₂H₆
- B C₃H₈
- C C₄H₈
- D C₄H₁₀

[SPM04-44] 3.2 g of copper (II) oxide powder is reacted with excess dilute nitric acid. What is the mass of copper (II) nitrate formed in the reaction? [Relative atomic mass: N=14, O=16, Cu=64]

- A 3.76 g
- B 4.96 g
- C 5.04 g
- D 7.52 g

[SPM09-43] What is the minimum mass of zinc required to react with excess dilute nitric acid to produce 240 cm³ of hydrogen at room conditions? [Molar volume of gas=24 dm³ mol⁻¹ at room conditions; Relative atomic mass: Zn=65]

- A 0.33 g
- B 0.65 g
- C 1.30 g
- D 6.50 g

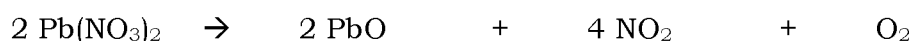
[SBPdiag06-49] 0.3 mole of magnesium reacts with 0.9 mole of hydrochloric acid to produce hydrogen gas. How many moles of hydrochloric acid are left unreacted?

- A 0.1
- B 0.3
- C 0.6
- D 0.9

[MRSM07-40] Heating ammonium salts with sodium hydroxide will produce ammonia gas. Which of the following ammonium salt can produce the greatest volume of ammonia gas?

- A 0.5 mol $(\text{NH}_4)_3\text{PO}_4$
- B 0.5 mol $(\text{NH}_4)_2\text{SO}_4$
- C 1.0 mol NH_4Cl
- D 1.0 mol NH_4NO_3

[SBPtrial11-41] The following equation shows the decomposition reaction of lead(II) nitrate when heated at room temperature and pressure.



Which of the following is true when 0.1 mol of lead(II) nitrate is decomposed?

[Relative formula mass : $\text{PbO} = 223$ and 1 mol gas occupies the volume of 24 dm^3 at room temperature and pressure]

- A 44.6 g of lead(II) oxide is formed.
- B 4800 cm^3 of nitrogen dioxide is given off.
- C 2.4 dm^3 of oxygen gases is given off.
- D 4.46 g of lead(II) oxide is formed.

[SPM03-48] The equation below represents the decomposition of hydrogen peroxide solution.



Which of the following are produced when 1 mol of hydrogen peroxide is decomposed completely?

[1 mole of gas occupies 24 dm^3 at room condition; Avogadro's Constant: $6 \times 10^{23} \text{ mol}^{-1}$]

- I 2 moles of water
- II 12 dm^3 of oxygen gas
- III 3×10^{23} of oxygen gas molecules
- IV 1.2×10^{23} of water molecules

- A I and II only
- B I and IV only
- C II and III only
- D II and IV only

Structure {Paper02}

[SPM06-02]

(a) (i) What is the concept introduced by Dmitri Mendeleev to simplify the idea of atomic mass and the volume of gas? [1M]

.....

(ii) Based on the concept in 2 (a)(i), what is the chemical symbol used to represent one water molecule? [1M]

.....

(iii) What is the name of the isotope of an element used as a standard in determining relative atomic mass? [1M]

.....

(b) (i) Based on the concept in (2)(a)(i), what is the mass of 6.0 dm³ of carbon dioxide gas, CO₂ at standard temperature and pressure? [2M]
[1 mol of gas occupies 22.4 dm³ at standard temperature and pressure;
Relative atomic mass for CO₂ = 44]

.....

.....

(ii) How many molecules are there in 6.0 dm³ of carbon dioxide gas? [1M]
[Avogadro's number = 6.02×10^{23}]

(iii) Explain briefly the relationship between the volume, mass and the number of molecules of carbon dioxide in 2 (b)(i) and 2 (b)(ii) at standard temperature and pressure. [3M]

.....

.....

.....

[SPM08-03b]

(b) Diagram 3.2 shows two balloons containing oxygen gas and carbon dioxide gas respectively.

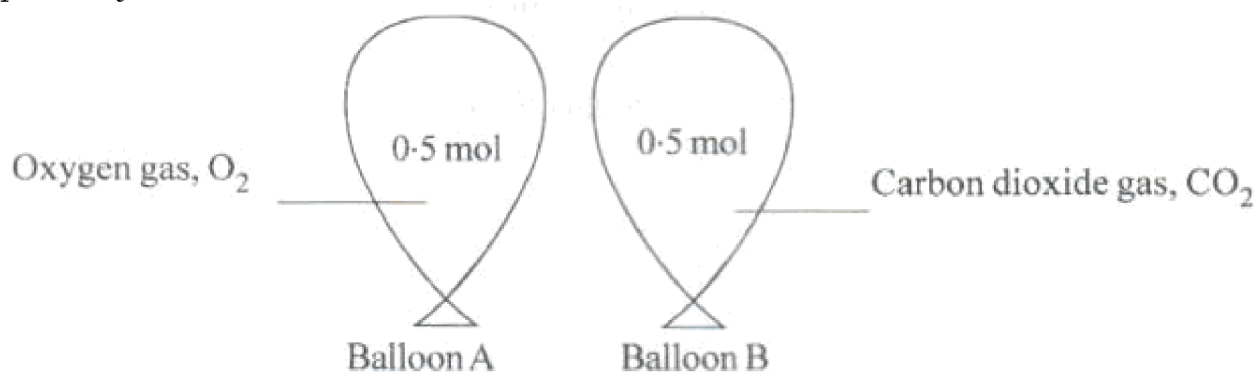


Diagram 3.2

Based on the given information:

(a) Calculate the mass of oxygen gas in balloon A. [1M]
[Relative atomic mass: O=16]

(ii) Calculate the volume of carbon dioxide gas in balloon B. [1 M]
[Molar volume of gas=24 dm³ mol⁻¹ at room temperature and pressure]

(iii) Compare the number of gas molecules in balloon A and in balloon B.
Explain your answer. [2 M]

.....
.....

[SBPmidyearF407-02]

Diagram 2.1 shows a syringe filled with carbon dioxide gas, CO₂ at room temperature and pressure.

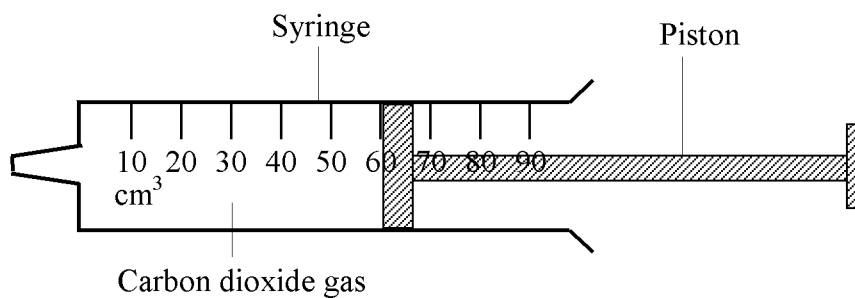


DIAGRAM 2.1

[Relative atomic mass: C=12, O=16, Molar volume=24 dm³ mol⁻¹ at room temperature and pressure]

(a) Calculate the number of moles of carbon dioxide gas in the syringe. [2M]

(b) Calculate

(i) the number of carbon dioxide molecules in the syringe. [1M]
[Avogadro Constant=6.02 x 10²³ mol⁻¹]

(ii) the number of atoms in the syringe.
[Avogadro Constant = 6.02 x 10²³ mol⁻¹]

(c) Diagram 2.2 shows 25 g of calcium carbonate, CaCO_3 .
[Relative atomic mass of C=12, O=16, Ca=40]

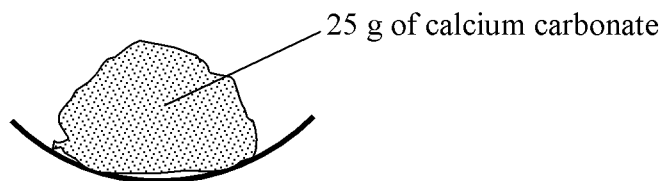


DIAGRAM 2.2

Calculate

(i) the relative formula mass of calcium carbonate. [1M]

(ii) the number of moles of calcium carbonate. [1M]

(iii) the percentage of oxygen by mass in calcium carbonate. [1M]

(d) The empirical formula of a compound is CH_2 . If the relative molecular mass of the compound is 84, what is its molecular formula? [3M]
[Relative atomic mass: H=1, C=12]

[SBPmidyearF406-03]

(a) Calculate the relative molecular or formula masses of the following substances.

(i) Ethanol, C_2H_5OH . [1M]

[Relative atomic mass: H=1, C=12, O=16]

(ii) Zinc nitrate, $Zn(NO_3)_2$ [1M]

[Relative atomic mass: O=16, N=14, Zn=65]

(b) A closed glass bottle contains 4 mol molecules of oxygen, O_2 .

[Avogadro constant is $6.02 \times 10^{23} \text{ mol}^{-1}$]

(i) What is the number of oxygen molecules in the bottle? [1M]

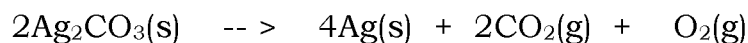
(ii) How many oxygen atoms are there in the bottle? [1M]

(c) Find the number of moles of atoms in a sample containing 9.03×10^{20} atoms of copper. [1M]

[Avogadro constant is $6.02 \times 10^{23} \text{ mol}^{-1}$]

(d) Calculate the mass, in gram, of 3.5 moles of copper(II) carbonate, CuCO_3 . [1M]
[Relative formula mass of $\text{CuCO}_3 = 124$]

(e) When silver carbonate, Ag_2CO_3 is heated, it will decompose to produce silver metal, carbon dioxide gas and oxygen gas as shown in the equation below.



A student heats 8.28 g silver carbonate. Calculate the volume of carbon dioxide gas, CO_2 collected at room temperature. [3M]

[Relative atomic mass: C=12, O=16, Ag=108, molar volume = $24 \text{ dm}^3 \text{ mol}^{-1}$ at room conditions]

[SPM03-01]

Diagram 1 shows the set up apparatus for an experiment to determine the empirical formula of magnesium oxide.

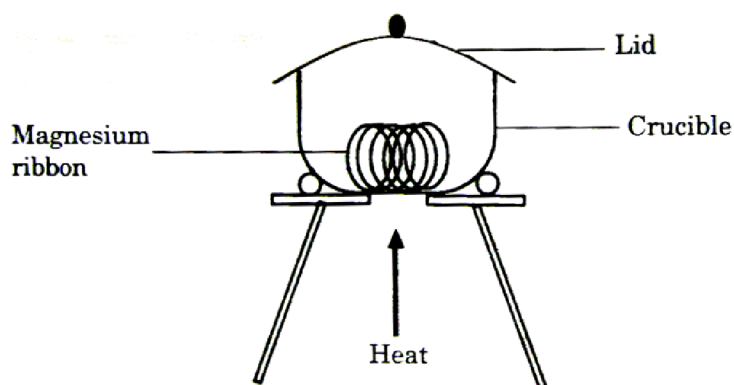


Diagram 1

Result

Mass of crucible + lid	= 24.0 g
Mass of crucible + lid + Magnesium ribbon	= 26.4 g
Mass of crucible + lid + magnesium oxide	= 28.0 g

(a) What is meant by empirical formula? [1M]

.....

.....

(b) Based on the above results,

(i) Calculate the mass of magnesium and the mass of oxygen that have reacted. [1M]

(ii) Calculate the mole ratio of magnesium atoms to oxygen atoms. [1M]
[Relative atomic mass: O=16, Mg=24]

(iii) Determine the empirical formula of magnesium oxide. [1M]

.....

(iv) Write the chemical equation for the reaction in the experiment [1M]

.....

(c) Why was the crucible lid opened once in a while during the experiment? [1M]

.....

.....

(d) Metal X is placed below hydrogen in the reactivity series. You are required to carry out an experiment to determine the empirical formula of the oxide of metal X. the apparatus provided are combustion tube, glass tube, cork, Bunsen burner and porcelain dish

(i) Draw the labelled diagram of the set-up of the apparatus for the experiment. [2M]

(ii) Describe the steps should be taken to ensure that all the air in the combustion tube has been expelled. [3M]

.....

.....

.....

.....

.....

[SBPtrial11-04]

The following information is about a sample of compound Q.

- Black solid
- Contains 2.56g copper and 0.64g oxygen

(a) What is the meaning of empirical formula? [1M]

.....

(b) Diagram 4 shows an incomplete equation which is one of the steps involved in determining the empirical formula. Complete this equation. [1M]

$$\text{Number of mole} = \frac{\text{_____}}{\text{Relative atomic mass}}$$

Diagram 4

(c) Based on the information of the sample of compound Q, calculate
[Relative atomic mass : Cu = 64 ; O = 16]

(i) Number of mole of copper [1M]
=

(ii) Number of mole of oxygen [1M]
=

(d) Determine the empirical formula of the compound Q. [1M]

.....

(e) Compound Q reacts completely with hydrogen gas to form copper and compound R.

(i) Name two substances that can be used to prepare hydrogen gas. [1M]

.....

(ii) Write a balanced chemical equation for the reaction that takes place. [2M]

.....

(iii) State one observation for the reaction. [1M]

.....

(iv) Name compound R. [1M]

.....

[SPM07-03]

(a) What is the meaning of empirical formula? [1M]

.....

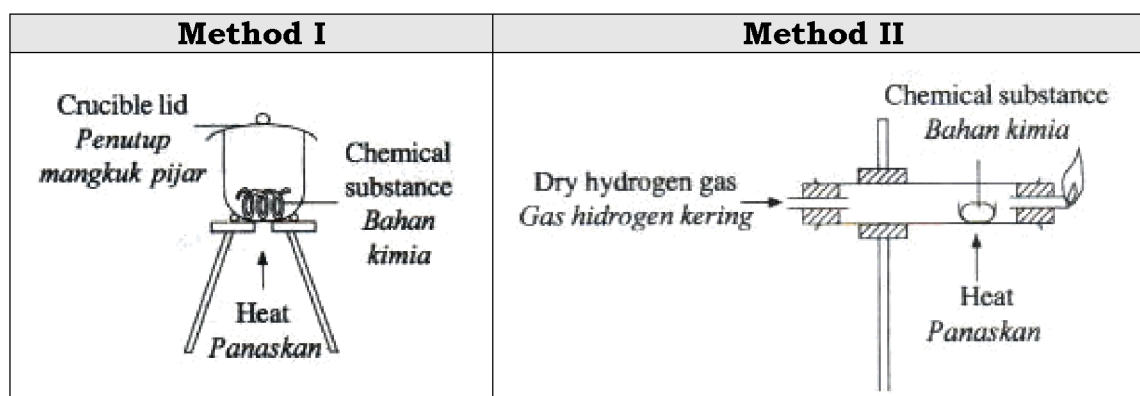
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(b) Diagram 3.1 shows an incomplete equation which is one of the steps involved in determining the empirical formula.
Complete this equation. [1 M]

$$\frac{\text{Mass}}{\text{relative atomic mass}} = \dots\dots\dots$$

Diagram 3.1

(c) Diagram 3.2 shows the apparatus set-up for two methods used to determine the empirical formula of two compounds.

**Diagram 3.2**

(i) Which method is suitable to use to determine the empirical formula of magnesium oxide? [1M]

.....

(ii) Why did you choose the method in 3(c)(i) ? [1M]

.....

(iii) When carrying out an experiment using method I, why does the crucible lid need to be opened once a while? [1 M]

.....

.....

(d) Diagram 3.3 shows the results for an experiment to determine the empirical formula of lead oxide.

Mass of combustion tube	= 64.00 g
Mass of combustion tube + lead oxide	= 117.52 g
Mass of combustion tube + lead	= 113.68 g

Based on diagram 3.3, determine the value of the following:
 [Relative atomic mass: O=16, Pb=207]

- (i) Mass of lead = g [1M]
- (ii) number of moles of lead = mol [1M]
- (iii) mass of oxygen = g [1M]
- (iv) number of moles of oxygen = mol [1M]
- (v) Empirical formula of lead oxide = [1M]

[SBPmidyearF507-02]

Figure 2 shows the setup of the apparatus used in an experiment to determine the empirical formula of an oxide of copper

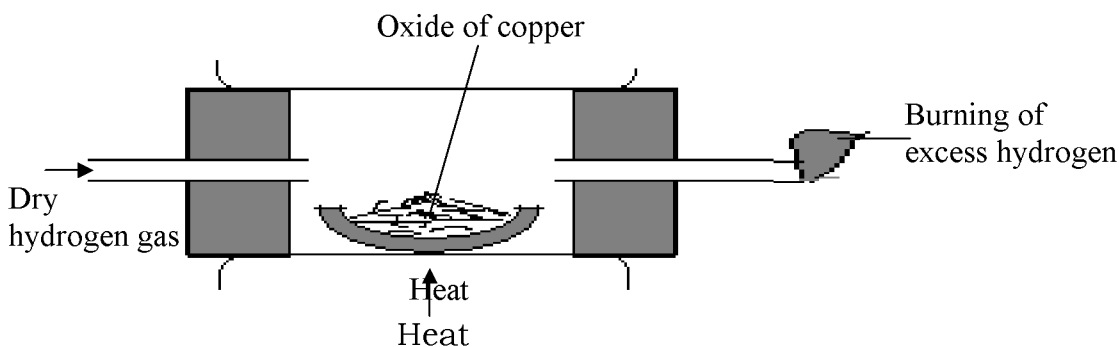


FIGURE 2

The following data was obtained:

Mass of combustion tube + porcelain dish	= 25.30 g
Mass of combustion tube + porcelain dish + oxide of copper	= 53.30 g
Mass of combustion tube + porcelain dish + copper	= 47.70 g

(a) What is meant by empirical formula? [1M]

.....

(a) Write the chemical equation for the reaction used to produce hydrogen gas. [1M]

.....

(c) Based on the data given

(i) Calculate the mass of copper and the mass of oxygen contained in the sample of oxide of copper. [2M]

Mass of copperg.

Mass of oxygeng

(ii) Calculate the mol ratio of copper to oxygen. [2M]
[Relative atomic mass: O=16, Cu= 64]

(iii) Write the empirical formula of the oxide of copper. [1M]

.....

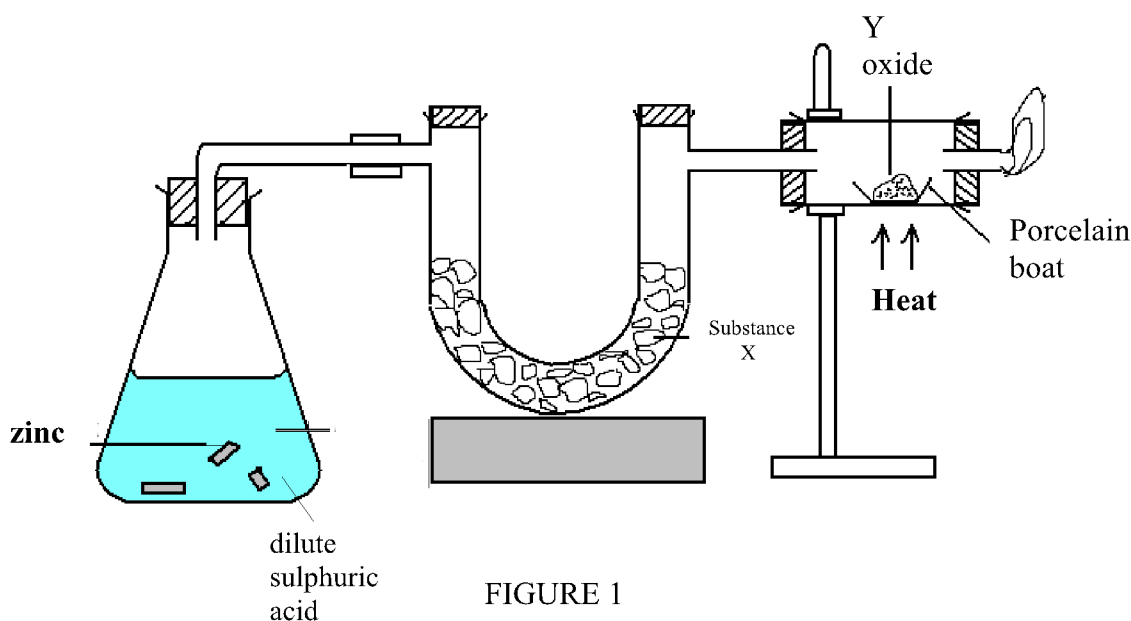
(vi) Write the chemical equation for the reaction between hydrogen and the oxide of copper. [1M]

.....

(c) The empirical formula for magnesium oxide can be determined by direct heating of magnesium. Draw the setup of the apparatus to carry out this experiment. [2M]

[MRSM05-01]

Diagram 1 shows the set-up of apparatus for an experiment to determine the empirical formula of Y oxide.



(a) Name the substance X used to dry the hydrogen gas. [1M]

.....

(b) Why is it necessary to dry the hydrogen gas? [1M]

.....

(c) State **two** observations at the combustion tube in this experiment. [2M]

.....

.....

(d) Table 1 shows the results obtained when a sample of Y oxide reacts with hydrogen gas.

Mass of empty porcelain boat	= 105.8 g
Mass of porcelain boat + Y oxide	= 111.2 g
Mass of porcelain + Y	= 110.6 g

Table 1

(i) Calculate the number of moles of Y atoms in the sample. [2M]
[Relative atomic mass: Y=64]

(ii) Calculate the number of moles of oxygen atoms in the sample. [2M]
[Relative atomic mass O=16]

(iii) Determine the empirical formula of Y oxide. [2M]

[SPM09-03]

Diagram 3 shows the apparatus set-up to determine the empirical formula of copper oxide.

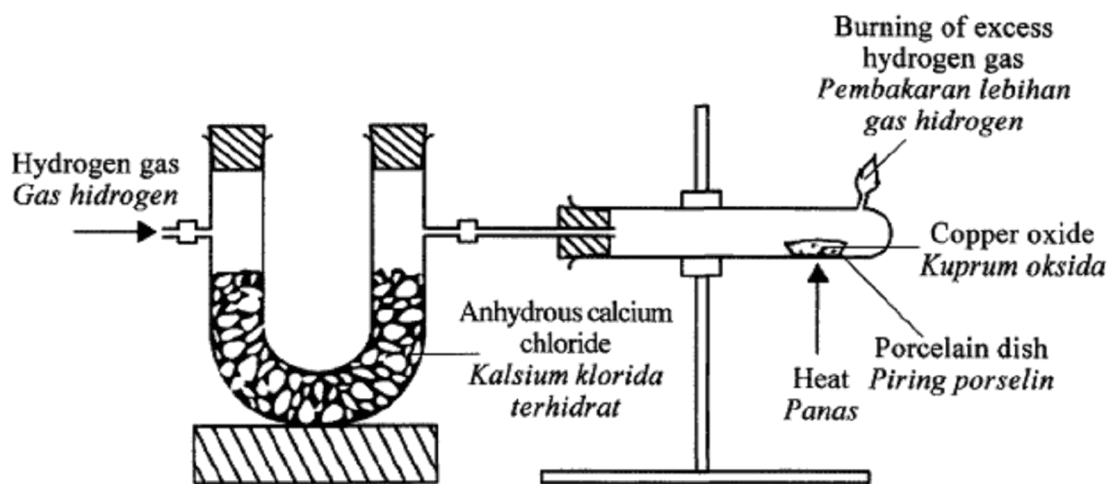


Diagram 3

Table 3 shows the result of this experiment.

Description	Mass (g)
Combustion tube + porcelain dish	32.25
Combustion tube + porcelain dish + copper oxide	42.25
Combustion tube + porcelain dish + copper	40.25

Table 3

(a)(i) What is the meaning of empirical formula? [1M]

.....

.....

(ii) State the function of the anhydrous calcium chloride. [1M]

.....

(b)(i) Based on Table 3, calculate the mass of:

Copper :

Oxygen :

(ii) Calculate the ratio of moles of copper to oxygen atoms.
[Relative atomic mass: Cu=64, O=16]

(iii) Determine the empirical formula copper oxide. [1M]

.....

(c)(i) Why is hydrogen gas passed through the combustion tube after heating has stopped? [1M]

.....

.....

(ii) State how to determine that the reaction between copper oxide with hydrogen has completed. [1M]

.....

.....

(d)(i) State why the empirical formula of magnesium oxide cannot be determined by using the same technique. [1M]

.....

(ii) State the name of another metal whose empirical formula can be determined using the same technique. [1M]

.....

[SBPmidyearF407-03]

Diagram 3 shows the setup of apparatus to determine the empirical formula of X oxide.

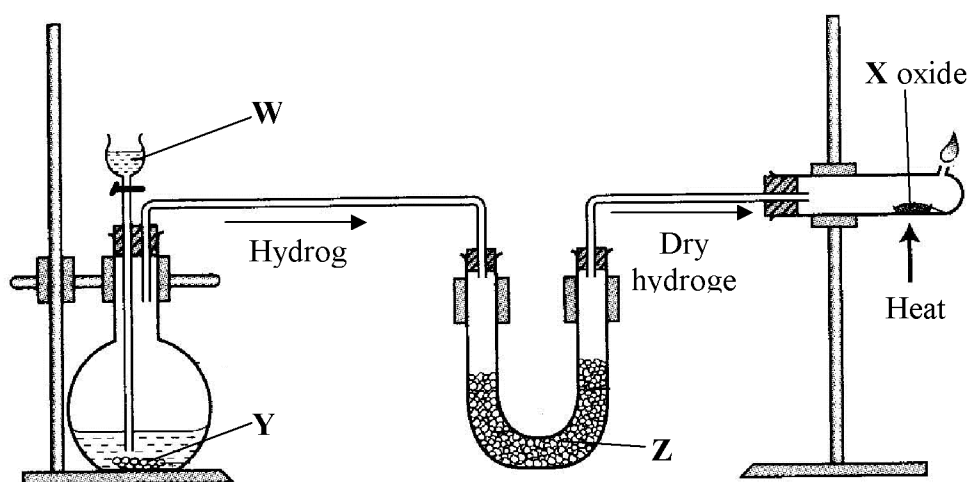


DIAGRAM 3

The following results were obtained from the experiment:

Mass of empty combustion tube	= 16.82 g
Mass of combustion tube + X oxide	= 18.27 g
Mass of combustion tube + X	= 17.98 g

(a) Name the chemical substances W, Y and Z used in Diagram 3. [3M]

W :

Y :

Z :

(b) Before X oxide is heated, hydrogen gas is allowed to pass through the apparatus until all the air in the combustion tube is completely removed.

How are you going to ensure that all the air has been removed? [2M]

.....

.....

(c) Determine the empirical formula of X oxide. [3M]
[Relative atomic mass: O=16, X=64]

(d) Can the empirical formula of magnesium oxide be determined using the same arrangement of apparatus as above? Explain your answer. [2M]

.....
.....

[SBPmidyearF406-02]

An experiment to determine the empirical formula of copper oxide was successfully done by a group of students using the reaction between hydrogen gas and copper oxide.

(a) Draw and label the set-up of the apparatus used to carry out this experiment. [2M]

(b) After the reaction is completed, hydrogen gas is allowed to continue flowing until the copper is cooled to room temperature. Explain why this is done. [1M]

.....
.....

(c) How to ensure that all the copper oxide is completely reacted? [1M]

.....
.....

(d) In this experiment, 16.13 g of copper oxide is completely reacted with excess hydrogen gas and 12.88 g of copper is produced.

(i) What is the observation when copper oxide changed to copper? [1M]

.....

(ii) What is the number of moles of copper in 12.88 g of copper? [1M]
[Relative atomic mass of Cu= 64]

(ii) Calculate the number of moles of oxygen atom in 16.13 g of copper oxide. [1M]
[Relative atomic mass of O=16]

(iii) Determine the empirical formula of this copper oxide. [2M]

Based on the result in (d)(iv) above, write a balanced equation to show the reaction between the copper oxide and hydrogen gas. [1M]

.....

[SBPdiag08-02]

An experiment was carried out in the school laboratory to determine the empirical formula of an oxide of copper by flowing hydrogen gas over heated copper oxide. Table 2 shows the results obtained.

Description	Mass (g)
Combustion tube + asbestos paper	36.20
Combustion tube + asbestos paper + copper oxide	39.40
Combustion tube + asbestos paper + copper	38.76

TABLE 2

(a) What is meant by ‘empirical formula’? [1M]

.....

.....

(b) Draw a labelled diagram to show the setup of the apparatus that can be used to carry out the experiment above. [2M]

(c) State **one** precautionary step to be taken when carrying out the experiment above. [1M]

.....

(d) Based on the results obtained,

(i) calculate the mass of copper and oxygen that have reacted. [1M]

(ii) determine the ratio of moles of copper atom to oxygen atom. [1M]
[Relative atomic mass: Cu=64, O=16]

(iii) determine the empirical formula of the copper oxide [1M]

(e) Write a balanced chemical equation for the reaction between copper oxide and hydrogen. [1M]

.....

(f) Can the empirical formula of magnesium oxide be determined through the experiment above? Give **one** reason for your answer. [2M]

.....

.....

[SBPdiag05-01]

Figure 1 below shows a set-up which is used by a student to determine the empirical formula of one metal L oxide.

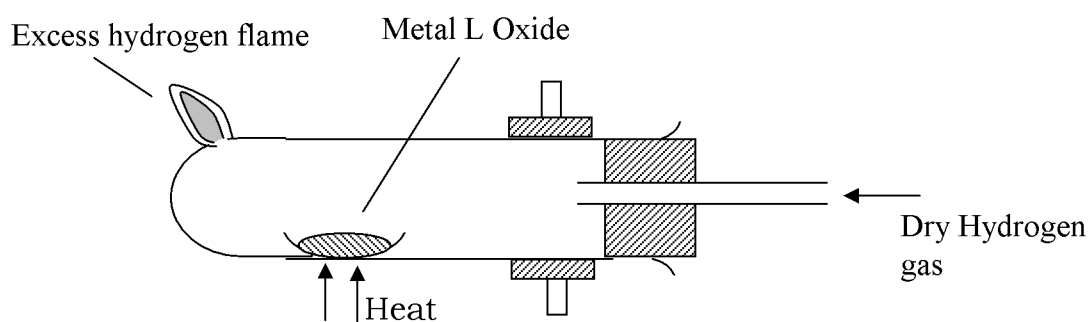


FIGURE 1

L is below hydrogen in The Electrochemical Series. The results obtained in this experiment are as follow:

Mass of heating tube + empty porcelain boat	= 52.45 g
Mass of heating tube + empty porcelain + metal L Oxide	= 105.97 g
Mass of heating tube + empty porcelain + metal L	= 102.13 g

(a) Name the chemical used to dry the hydrogen gas in this experiment. [1M]

.....

(b) State how to ensure all metal L oxide changes to metal L. [1M]

.....

.....

(c) In the above experiment, hydrogen gas continues to flow until the product, metal L becomes cool. Explain why. [1M]

.....

.....

(d) Using the above results, determine the empirical formula for oxide L. [3M]
[Relative Atomic Mass: L=207, O=16]

(e) Based on your answer in (d), write a chemical equation for the chemical reaction.

.....

(f) Why is the method that used above is not suitable to determine the empirical formula of magnesium oxide?

.....

(g) Draw the set-up of apparatus to determine the empirical formula of magnesium oxide.

[2 mark]

[SBPtrial06-02] {Translate}

One experiment of the reaction of oxide of copper with hydrogen to determine the empirical formula of oxide metal was done in the laboratory. The data collected was recorded as table below.

Description	Mass (g)
Combustion tube + asbestos paper	36.20
Combustion tube + asbestos paper + oxide of copper	39.40
Combustion tube + asbestos paper + copper	38.76

Table 2

(a) What mean by the empirical formula? [1M]

.....

(b) Draw the set-up of diagram for the experiment. [2M]

(c) State one precaution step that should be taken for the experiment.

.....

(d) Based of data collected,

(i) Calculate the mass of copper and mass of oxygen reacted. [1M]

(ii) Calculate the ratio of mol for the copper atom to oxygen atom. [1M]
[Relative atomic mass: Cu=64, O=16]

(iii) Determine the empirical of oxide of copper. [1M]

(e) Write the chemical equation for the reaction of oxide of copper with hydrogen gas.
[1M]

.....

(f) Can the oxide of magnesium be determined by the method above? Give the reason.
[1M]

.....

.....

[SBPtrial09-03]

Diagram 3 shows the apparatus set-up to determine the empirical formula of oxide metal M.

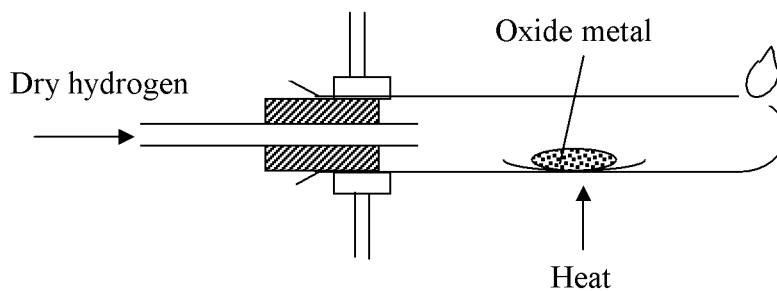


Diagram 3

(a) (i) State the name of two reactants to prepare hydrogen gas in the laboratory. [1M]

.....

(ii) Write the chemical equation for the reaction in (a)(i). [1M]

.....

(b) State one precaution that must be taken when carrying out the experiment. [1M]

.....

(c) Table 3 shows the results of the experiment:

Mass of combustion tube + asbestos paper	36.50 g
Mass of combustion tube + asbestos paper + M oxide	37.30 g
Mass of combustion tube + asbestos paper + M	37.14 g

Table 3

(i) Based on the results in Table 3, determine the empirical formula of M oxide. [3M]
[Relative atomic mass: O=16, M=64]

(ii) Write the chemical equation for the reaction between M oxide and hydrogen gas. [1M]

.....

(d) (i) The empirical formula of magnesium oxide cannot be determined by the above method. Explain why. [1M]

.....

(ii) Draw a suitable set up of apparatus for the experiment to determine the empirical formula of magnesium oxide. [2M]

[MRSM06-02]

Diagram 2 shows the apparatus set up used in an experiment to determine the empirical formula for an oxide of copper.

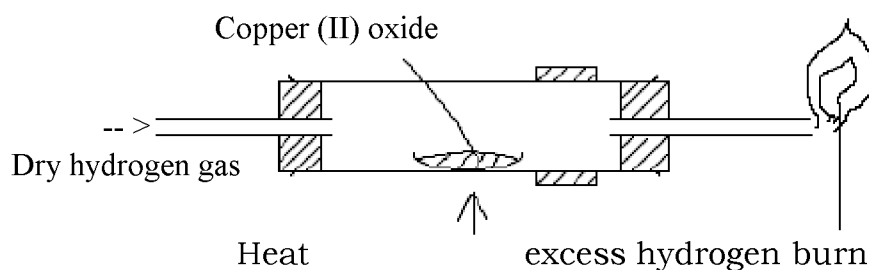


Diagram 2

The following data was obtained based on the experiment:

Mass of copper (II) oxide	= 2.00 g
Mass of copper	= 1.60 g

(a) What is meant by empirical formula? [1M]

.....

(b) Name one substance that can be used to dry the hydrogen gas. [1M]

.....

(c) Why does the hydrogen gas need to be passed through the combustion Tube for a few minutes before heating? [1M]

.....
.....

(d) How do you ensure the reaction is complete? [1M]

.....
.....

(e) Based on the above result,

(i) Calculate the number of moles for copper atoms and oxygen atoms that react. [2M]
[Relative atomic mass: O=16, Cu=64]

(ii) Determine the smallest ratio for the number of moles for copper atoms to oxygen atoms. [1M]

(iii) What is the empirical formula for this oxide of copper? [1M]

.....

(f) Why does the empirical formula of magnesium oxide cannot be determined using the above method? [1M]

[SBPdiag07-02]

Figure 2 shows the setup of the apparatus to study the effect of heat on copper(II) carbonate

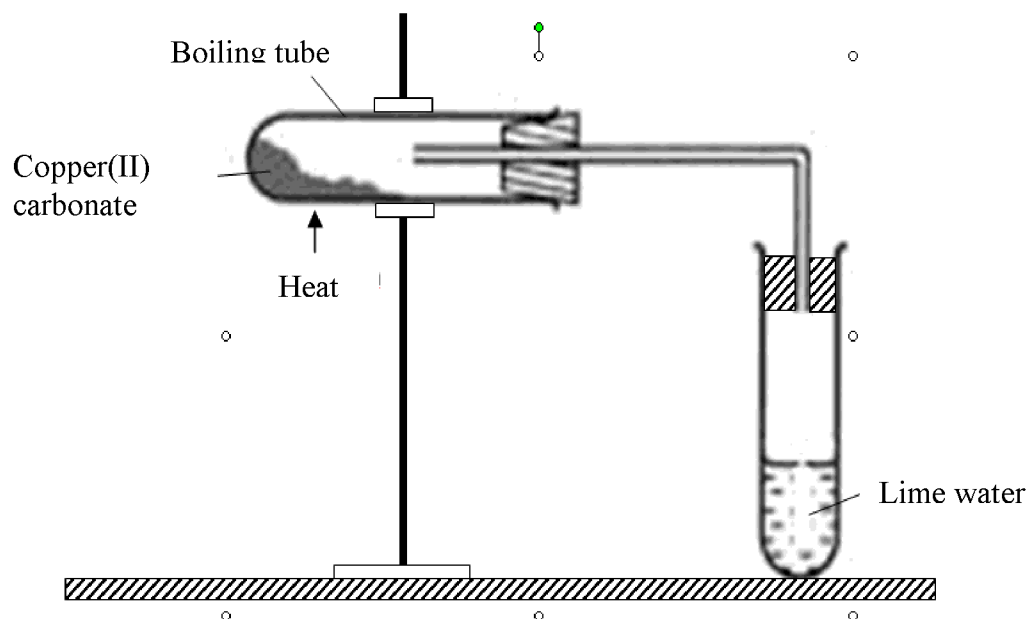


FIGURE 2

There are two errors in the setup of the apparatus in Figure 2.

(a) Draw the correct set up of the apparatus in the space provided below. [2M]

(b) After the correction was done the heating of a sample of copper(II) carbonate was carried out and the lime water turns cloudy.

(i) Write the formula for copper(II) carbonate [1M]

.....

(ii) Name the solid product formed after complete heating of copper(II) carbonate. [1M]

.....

(iii) Name the gas released. [1M]

.....

(iv) Write the equation for the heating of copper(II) carbonate. [1M]

.....

(c) Table 2 shows the result of the experiment.

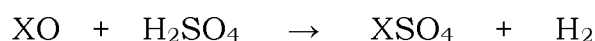
Materials	Mass / g
Mass of boiling tube	10.64
Mass of boiling tube and copper(II) carbonate	11.89
Mass of boiling tube and product from heating of copper(II) carbonate	11.45

TABLE 2

(i) What is the mass of gas released? [1M]

(ii) Calculate the volume of the gas released at room temperature and pressure. [2M]
[Relative atomic mass: C=12, O=16, Cu=64, 1 mol of gas occupies a volume of 24 dm³ at room temperature and pressure]

(d) In a different experiment, 8.1 g of an oxide for element X with the formula XO reacts with excess sulphuric acid according to the following equation:



Calculate the number of moles of the salt XSO₄ produced. [1M]
[Relative formula mass: XO=81, XSO₄=161]

[SBPdiag06-02]

Figure 2 shows the structural formula of compound X.

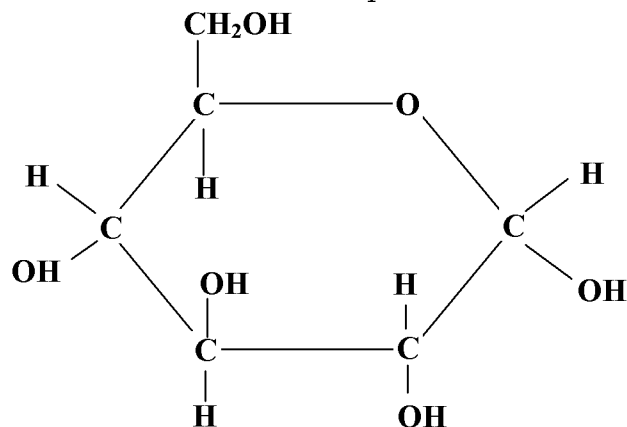


FIGURE 2

(a) What is the meaning of molecular formula? [1M]

.....

(b) Write the molecular formula of compound X. [1M]

.....

(c) Can compound X conduct electricity? State a reason for your answer. [2M]

.....

(d) Compound Y contains 52.2% of carbon, 13.0% of hydrogen and 34.8% of oxygen by mass. [Relative atomic mass: H=1, C=12, O=16]

(i) Find the empirical formula of compound Y. [3M]

(ii) If the molar mass of compound Y is 46 g mol^{-1} , find its molecular formula. [2M]

Essay {Paper02}

[MRSM10-09a]

(a) The reaction between sodium and chlorine forms a compound with a high melting point. Determine the mass of the compound formed when 2.3 g sodium reacts with excess chlorine.

[Relative atomic mass Na= 23, Cl= 35.5] [4M]

-----oooOO aĐaŽ OOooo-----

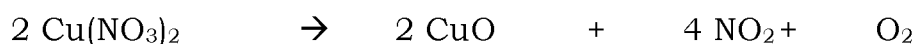
[MRSM10-08]

(a)

**The molecular formula of butane is C_4H_{10}
and its empirical formula is C_2H_5**

Based on the statement, explain the meaning of empirical formula and molecular formula. [4M]

(b) The decomposition of copper(II) nitrate is shown in the following equation:



[Relative atomic mass: N=14, O=16, Cu=64, molar volume of gas at room condition; $24 \text{ dm}^3 \text{ mol}^{-1}$]

(i) Determine the percentage composition by mass of oxygen in copper(II) nitrate. [3 marks]

(ii) If 3.2 g of copper(II) oxide is produced during the heating process, calculate the volume of oxygen gas evolved at room condition. [3 marks]

(c) A student carried out two experiments to determine the empirical formulae for magnesium oxide and copper(II) oxide. Diagram 8 shows the apparatus set-up for both experiments.

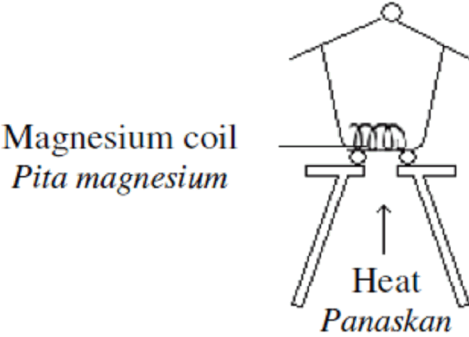
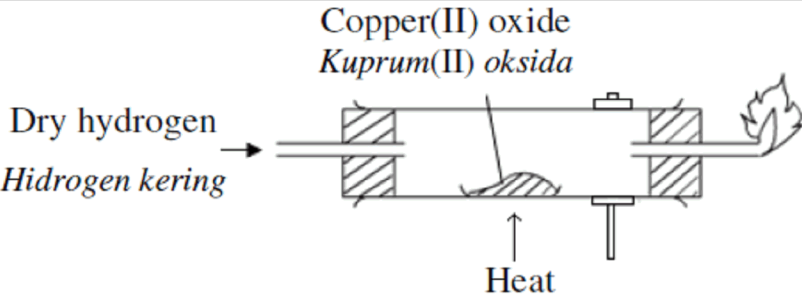
<p>Experiment I</p>	
<p>Experiment II</p>	

Diagram 8

Explain the differences in the method used for the determination of the empirical formulae for both oxides. [4 marks]

-----oooOO aĐaŽ OOooo-----

[SPM2010-07a]

(a) A hydrocarbon X, consists of 82.75 % of carbon and 17.25 % of hydrogen by mass. The relative molecular mass of X is 58.

[RAM : C = 12, H = 1]

(i) Determine the empirical formula and molecular of hydrocarbon X. [6M]

(ii) Draw the structural formula of the two isomers of hydrocarbon X. [4M]

-----oooOO aĐaŽ OOooo-----

[SBPtrial07-08]

(a) What is meant by empirical formula? [1M]

(b) A carbon compound contains 92.3% of carbon and 7.7% of hydrogen by mass. The relative molecular mass of this compound is 78.

Find the molecular formula of this compound. [5M]

[Relative atomic mass: C=12, H=1]

(c) Describe how you could determine the empirical formula of magnesium oxide in the laboratory. Your description should include [14M]

- procedure of experiment
 - tabulation of result
 - calculation of the results obtained
- [Relative atomic mass: O=16, Mg=24]

[SBPmidyearF508-08]

(a) What are meant by empirical formula and molecular formula. [2M]

(b) A carbon compound has an empirical formula of CH_2 and a molar mass is 70 g mol^{-1} , determine its molecular formula. [3M]

[Relative atomic mass: $\text{H}=1$, $\text{C}=12$]

(c) (i) Metal Z reactively react with oxygen to form Z oxide. Describe the procedure to determine the empirical formula of Z oxide. The procedure should include a precaution. [10M]

(ii) Diagram 8 shows the result obtains in c (i).

Mass of crucible + lid, g	=	46.30
Mass of crucible + lid + Z, g	=	46.30
Mass of crucible + lid + Z oxide, g	=	46.62

Diagram 8

Based on the information in Table 8, determine the values of the following:

[Relative atomic mass: $\text{O}=16$, $\text{Z}=65$] [5M]

- mass of lead
- number of moles of lead
- mass of oxygen
- number of moles of oxygen
- empirical formula of lead oxide

-----oooOO aĐaŽ OOooo-----

[SBPtrial08-09a]

(a) Diagram 9 shows the set up of the apparatus to determine the empirical formula of oxide of metal M. M is less reactive than hydrogen.

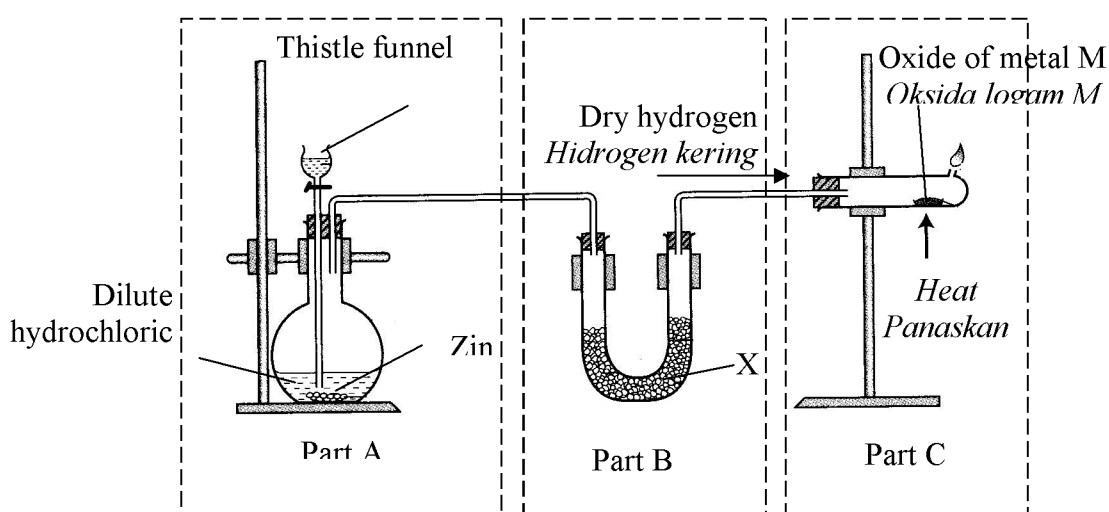


Diagram 9

- (i) State two precautions that must be taken in Part A while carrying out the experiment. [2M]
- (ii) Suggest a suitable chemical substance for X in Part B and state the function of X. [2M]
- (iii) Describe the reaction that occurs in Part C. [2M]
- (iv) Information below shows the results of the experiment.

Mass of combustion tube + porcelain dish	= 52.34 g
Mass of combustion tube + porcelain dish + oxide of M	= 105.86 g
Mass of combustion tube + porcelain dish + M	= 102.02 g

Determine the empirical formula of the oxide of M: [4M]
 [Relative atomic mass of O = 16, M = 207]

-----oooOO aĐaŽ OOooo-----

[SBPmidyearF406-07b]

- (a) Magnesium can react actively with oxygen to form magnesium oxide. Describe an activity that can be carried out in the laboratory to determine the empirical formula of magnesium oxide. Include the calculations involved in your answer. [11M]
 [Relative atomic mass: O=16, Mg = 24]

-----oooOO aĐaŽ OOooo-----

[SBPdiag08-07]

Diagram 7 shows the formulae of 4 types of gases released during the eruption of a volcano.

N ₂	CO ₂	H ₂ S	H ₂ O
----------------	-----------------	------------------	------------------

DIAGRAM 7

- (a) Calculate the molar mass of each gas shown in Diagram 7. [4M]
 [Relative atomic mass: H, 1; C, 12; O, 16; N, 14; S, 32]
- (b) Show that 0.9 g of water vapour contains the same number of molecules as in 2.2 g of carbon dioxide. [4M]
 [Relative atomic mass: H, 1; C, 12; O, 16; Avogadro Constant, N_A = 6.02 X 10²³]
- (c) A sample contains 0.1 mol carbon dioxide gas at room temperature and pressure. [Relative atomic mass: C, 12; O, 16; 1 mol of gas occupies a volume of 24 dm³ at room temperature and pressure; Avogadro Constant, N_A = 6.02 X 10²³]

Calculate: [5M]

- the volume,
- the mass,
- the number of molecules and
- the number of atoms of the 0.1 mol carbon dioxide gas in the sample.

(d) At very high temperature, hydrogen sulphide gas released from the eruption of the volcano will react with oxygen in the air to produce sulphur dioxide and water vapour.

Referring to the information above,

- (i) write a balanced chemical equation to represent the reaction.
 (ii) calculate the maximum mass of sulphur dioxide produced if 952 g of hydrogen sulphide is released from the volcanic eruption. [7M]

-----oooOO aĐaŽ OOooo-----

[SBPdiag06-07c]

- (b) Figure 7 shows the electron arrangement of ion Y^{3+} .

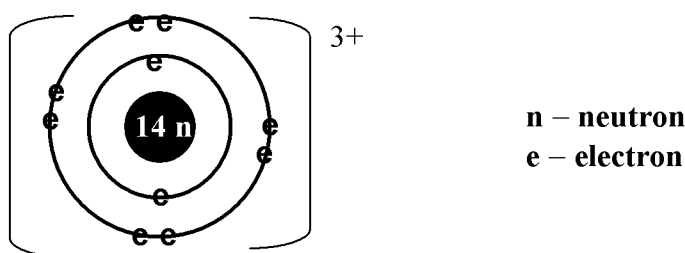
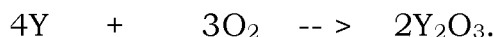


FIGURE 7

- (i) Calculate the nucleon number of atom Y. [2M]
 (ii) Y reacts with oxygen to form oxide Y, with the formula Y_2O_3 .
 The chemical equation for reaction Y with oxygen is show as:



[Relative atomic mass: $Y=27$, $O=16$]

Calculate the mass of oxide Y, Y_2O_3 formed when 10.8 g Y is completely burnt in oxygen. [4M]

-----oooOO aĐaŽ OOooo-----

[SBPdiag05-essay03]

- (a) Solid Copper (II) nitrate decomposed to copper (II) oxide, nitrogen dioxide gas and oxygen gas when it is strongly heated.
 Write one balance equation to represent the composition process and label physical state for every reactant and product. [2M]
 (b) (i) Below is the information of hydrogen and oxygen.

96 dm³ hydrogen gas and 96 dm³ oxygen gas consist different masses at room condition.

Explain the above statement. [3M]

[Relative Atomic Mass: H=1, O=16, 1 mole gas occupied 24 dm³ at room condition]

(ii) Information given shows the empirical formula for lactic acid.



Relative molecular mass for lactic acid is 90. Determine the molecular formula for lactic acid.

[Relative atomic Mass: C=12, H=1, O=16]

By referring to lactic acid, state the differences between empirical formula and molecule formula. [5M]

(b) **X Metal burns rapidly in oxygen.**

Describe one experiment how to determine the empirical formula for X oxide.

In your explanation, include a label diagram for the apparatus used, result of the experiment and precaution be taken to get more accurate result. [10M]

-----oooOO aĐaŽ OOooo-----

[MRSM06-08b]

Diagram 8.1 shows the production of fertilizer Z in the laboratory from the reaction between ammonia gas and diluted sulphuric acid.

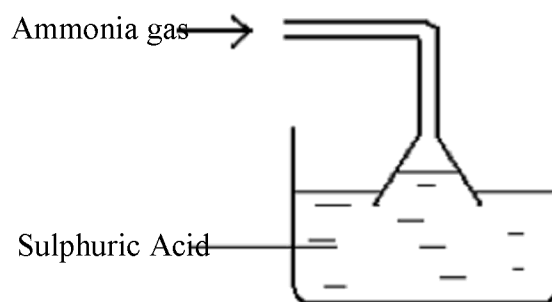


Diagram 8.1

(i) Name fertilizer Z. [1M]

(ii) Write a balanced chemical equation for the production of fertilizer Z. [2M]

(iii) Calculate the volume of ammonia gas required to react completely with sulphuric acid if 13.2 g of fertilizer Z is produced. [3M]

[The molar mass of Z=132 g mol⁻¹ and the molar volume of gas is 24.0 dm³ at room temperature and pressure]

-----oooOO aĐaŽ OOooo-----

[MRSM04-07]

The empirical formula of substance Z is



(a) What is the information that can be deduced from this formula? [2M]

(b) The molar mass for substance Z is 180 gmol^{-1} . Determine the molecular formula of substance Z. [2M]

[Relative Atomic Mass: H=1, C=12, O=16]

(c) A student carried out two experiments to determine the empirical formulae for magnesium oxide and copper (II) oxide. Diagram 5 shows the apparatus set-up for both experiments.

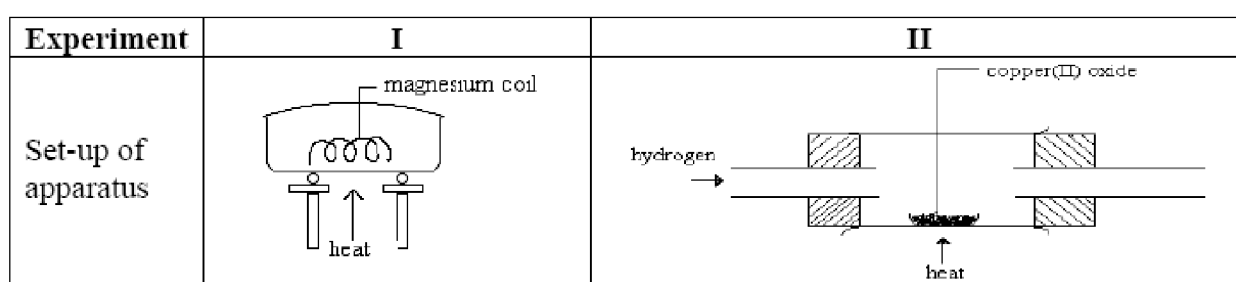


Diagram 5

(i) Suggest one industrial application for the reaction in experiment II and give an example. [2M]

(ii) Explain the differences in the method used for the determination of the empirical formulae for both oxides. [4M]

(iii) Compare the precautionary steps that need to be taken in both experiments to obtain an accurate result.

(iv) The reactions in both experiments are redox reactions. [4M]

Explain this statement based on the changes in the oxidation number.

-----oooOO aĐaŽ OOooo-----

[MRSM03-07b]

(b) Ethanol ($\text{C}_2\text{H}_5\text{OH}$) is an efficient fuel. Complete combustion of ethanol produces carbon dioxide and water.

During an experiment, a student burned 2.3 g ethanol in excess oxygen.

(i) Write an equation for the complete combustion of ethanol. [1M]

(ii) Calculate the volume of carbon dioxide evolved at room conditions, [3M]

[Relative atomic mass: H=1, C=12, O=16, 1 mol gas occupies 24 dm^3 at room conditions]

-----oooOO aĐaŽ OOooo-----

Structure {Paper03}

[SPM04-01-P3]

A Student carried out an experiment to determine the empirical formula of magnesium oxide. The steps and set-up of apparatus of the experiment are shown in Diagram 1.

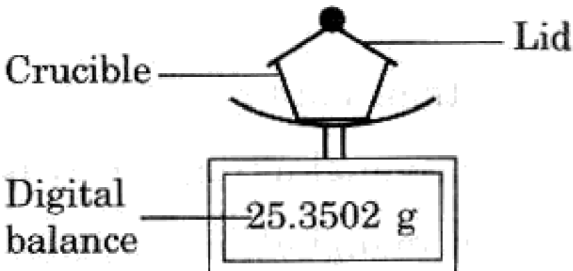
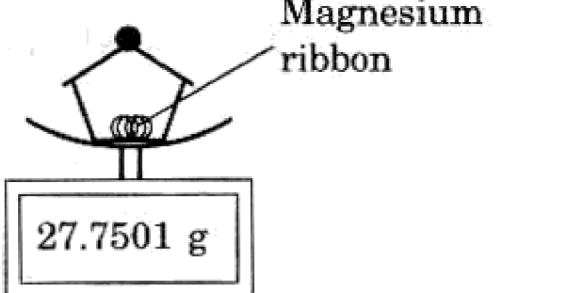
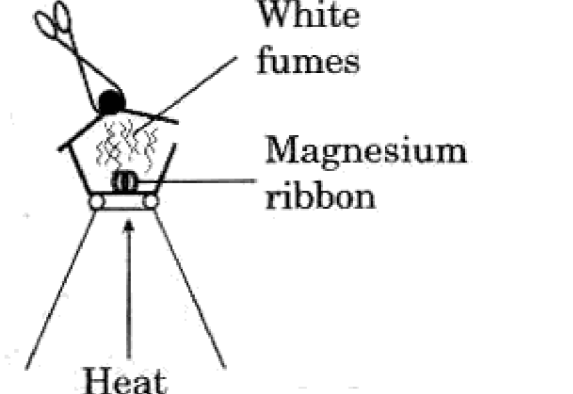
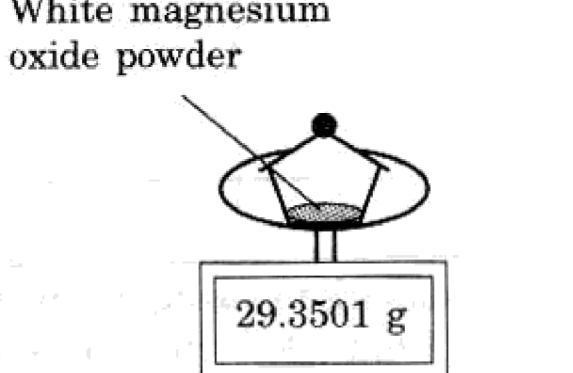
Step	Set-up of apparatus
1. Crucible and lid are weigh	
2. Crucible, lid and magnesium ribbon are weigh	
3. Magnesium ribbon is heated until the reaction is complete	
4. Crucible, lid and magnesium oxide are weigh when cooled.	

Diagram 1

(a) Complete the following table by stating the observations and related inferences in the experiment.

Observations	Inferences
(i)	(i)
.....
(ii)	(ii)
.....

(b) Record the reading to two decimal places for: [3M]

The mass of crucible and lid : g

The mass of crucible, lid and magnesium ribbon : g

The mass of crucible, lid and magnesium oxide when cooled : g

(c) (i) What is the mass of magnesium that has been used?

(ii) What is the mass of oxygen which reacted with magnesium?

(iii) Determine the empirical formula of magnesium oxide. [3M]
[Relative atomic mass: Mg=24, O=16]

(d) Based on your answer in (c)(iii), how many moles of magnesium and oxygen atoms have reacted? [3M]

.....

[SBPdiag06-01-P3]

A student carried out an experiment to determine the empirical formula of zinc oxide. The steps and set-up of apparatus of the experiment are shown in Figure 1.

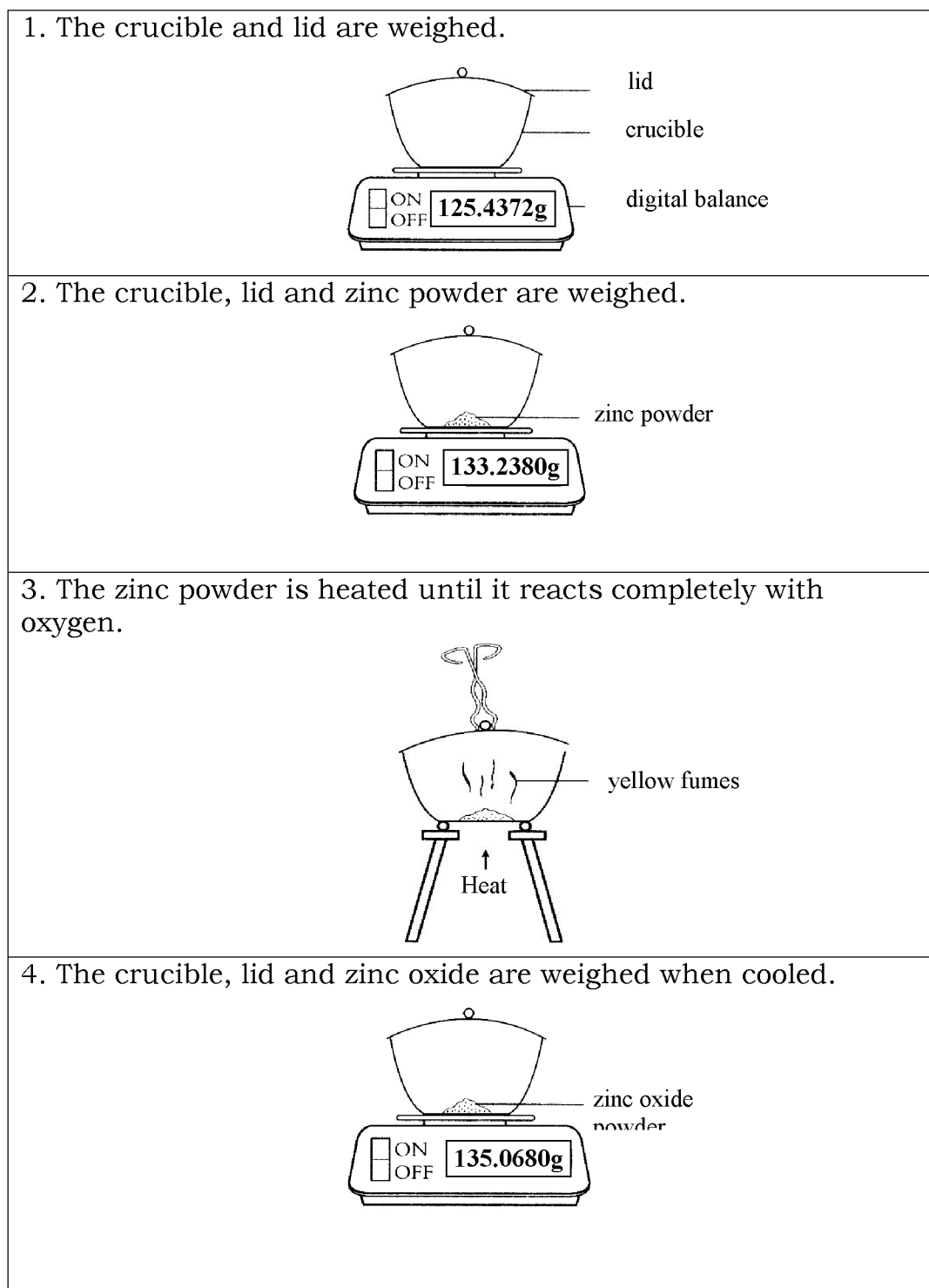


Figure 1

(a) Complete the following table by stating the observations and related inferences in the experiment. [6M]

Observations	Inferences
(i)	(i)
(ii)	(ii)
(iii)	(iii)

(a) Round off the reading to two decimal places and record it in the table below. [3M]

Description	Mass / g
The crucible and lid.	-----
The crucible, lid and zinc powder.	-----
The crucible, lid and zinc oxide.	-----

(c) (i) Calculate the mass of zinc that has been used.

(ii) Calculate the mass of oxygen which reacted with zinc.

(iii) Determine the empirical formula of zinc oxide. [3M]
[Relative atomic mass: O=16, Zn=65]

(d) The student wants to determine the empirical formula of copper(II) oxide. He used the steps and set-up of apparatus as the experiment before.

Predict whether the empirical formula of copper(II) oxide can be determined.

Explain your answer. [3M]

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(e) Below are some oxides of element.

- magnesium oxide
- sulphur dioxide
- carbon dioxide
- copper(II) oxide

Classify the oxides into two groups, those which are basic oxides and those which are acidic oxides. Put your answer in a suitable table. [3M]