

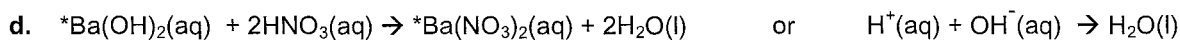
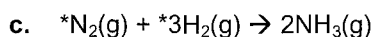
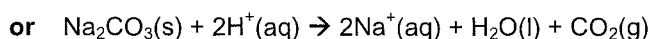
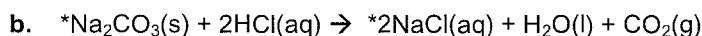
SECTION A – Multiple choice questions (20 marks)

1 C	6 C	11 D	16 C
2 D	7 C	12 B	17 B
3 D	8 C	13 B	18 A
4 B	9 A	14 B	19 A
5 A	10 C	15 D	20 B

SECTION B – Short answer questions (56 marks)

Question 1 (8 marks) Two marks per equation.

Suggested mark scheme of ½ mark for each correct formula indicated by star; and 1 mark for balanced equation. For ionic equations 1 mark for balanced equation and 1 mark for physical states.



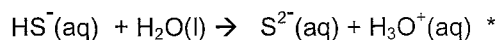
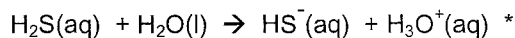
Question 2 (8 marks) * = 1 mark.

a. (i) Ammonia solution is a weak base as only a small proportion of NH_3 molecules ionise.*

The presence of NH_3 molecules acting as a proton (H^+) acceptor allows the solution to act as a base.*

(ii) In the reaction water is acting as an acid*, as it is donating a proton (H^+).*

b. Hydrogen sulfide in solution can donate two protons.



c. (i) H_2CO_3 * (ii) CO_3^{2-} *

Question 3 (5 marks)

a. (i) $n(\text{Fe}_2\text{O}_3) = 3.20/159.8$
 $= 0.0200 \text{ mol} *$

(ii) $n(\text{HCl}) = 6 \times 0.0200 = 0.120 \text{ mol} *$

(iii) $V(\text{HCl}) = 0.120/2.00$
 $= 0.0600 \text{ L (60.0 mL)} *$

Question 3 (continued)

$$\text{b. Percentage of oxygen in K}_2\text{Cr}_2\text{O}_7 = \frac{(7 \times 16.0)}{(2 \times 39.1) + (2 \times 52.0) + (7 \times 16.0)} = 38.0\% *$$

$$\text{Percentage of oxygen in C}_6\text{H}_{12}\text{O}_6 = \frac{(6 \times 16.0)}{(6 \times 12.0) + (12 \times 1.0) + (6 \times 16.0)} = 53.3\% *$$

Glucose has the higher percentage of oxygen by mass.

Question 4 (7 marks)

a. (i) mole ratio	C 40.91/12.0	:	H 4.54/1.0	:	O 54.55/16.0	
	= 3.41	:	4.54	:	3.41	*
Simplest ratio	= 1.00	:	1.33	:	1.00	*
Whole number ratio:	= 3	:	4	:	3	
Empirical formula	$\text{C}_3\text{H}_4\text{O}_3$ *					

(ii) Empirical formula mass $\text{C}_3\text{H}_4\text{O}_3 = 88\text{g mol}^{-1}$

Molecular formula mass = 176g mol^{-1}

Molecular formula is $\text{C}_6\text{H}_8\text{O}_6$ *

b. Abundance of ^{123}Sb isotope = x% Abundance of ^{121}Sb isotope = $(100 - x)\%$

$$(123x) + 121(100-x) / 100 = 218 \quad *$$

Solving for x: x = 40% *

Abundance of ^{123}Sb isotope = 40% Abundance of ^{121}Sb isotope = 60% *

Question 5 (8 marks)

- a. (i) Place a glowing splint into the test tube. If it catches alight the gas is oxygen. *
- (ii) Bubble the gas through limewater. If the solution goes milky/cloudy the gas is carbon dioxide. *
- b. Argon is used as an inert atmosphere e.g. in light globes or in arc welding. * Argon is a noble gas, its stable number of electrons in the outer shell makes it unreactive. *
- c. Carbon dioxide does not support combustion* and being denser than air smothers the fire by preventing oxygen from reaching the fuel. *
- d. $n(\text{CO}_2) = 4.90 \times 10^3 / 24.5 = 200 \text{ mol} *$
- Mass(CO_2) = $200 \times 44.0 = 8800\text{g} (8.80\text{kg}) *$

Question 6 (9 marks)

- a. Charles' Law: The volume of a fixed amount of gas at constant pressure is directly proportional to its absolute temperature. (1 mark for relationship between volume and temperature; 1 mark for constant pressure and amount of gas).
- b. $V_1/T_1 = V_2/T_2$
- $30.0/295 = 60.0/T_2$ * for temperatures in Kelvin.
- $T_2 = 590\text{K}$
- $= 317^\circ\text{C}$ *

- c. When the can is heated, gas particles gain energy and collide with the walls of the container more often, which corresponds to an increase in pressure.* As the volume is fixed, the increased pressure might split the can, causing it to explode.*
- d. $P_1V_1/T_1 = P_2V_2/T_2$ * for correct relationship
 $(102 \times 340)/293 = (105 V_2)/313$ * for correct values
 $V_2 = 353 \text{ mL}$ *

Question 7 (5 marks)

- a. Zinc *, as it reacted with each of the solutions tested.*
- b. (Zn) Pb Cu Ag *
- c. $2\text{Ag}^+(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag}(\text{s})$ *
- d. The rate of the reaction might be too slow to observe.*

Question 8 (5 marks)

- a. If the painted surface is damaged, the metal is exposed to air (oxygen) and water, which will cause corrosion.*
- b. (i) Magnesium or zinc.* The sacrificial electrode is more reactive than iron, and oxidises in preference to it.*
- (ii) An opposing current makes the iron a cathode instead of an anode*, preventing the electron flow (or formation of Fe^{2+}) that results from oxidation of the iron.*