

SECTION A: MULTIPLE CHOICE QUESTIONS

Five possible answers **A, B, C, D, E** are given for each of the twenty-eight questions in this section. Choose the **ONE** you consider to be best. Each question in this section is worth one mark, for a total of 28 marks.

- 1 A pure solid decomposes on heating, yielding a solid and a gas, each of which is a pure substance. From this we can conclude with certainty that
- A the original solid is not an element.
 - B at least one of the products is an element.
 - C both of the products are elements
 - D the original solid is a mixture
 - E both **A** and **B**.
- 2 Each of the following are physical properties of the element iodine *except*
- A color: grayish black
 - B characteristic odour
 - C density is 4.6 g cm^{-3}
 - D the melting point is 113.5°C
 - E reacts vigorously with water
- 3 Which one of the following is *not* a heterogeneous mixture
- A salt and sulphur
 - B conch salad
 - C olive oil
 - D a school of fish
 - E mud
- 4 The diatomic gases H_2 , O_2 and N_2 are considered to be
- A elements
 - B compounds
 - C atoms
 - D mixtures
 - E alloys
- 5 When a drop of bromine is placed in the bottom of a gas jar, the colour of the vapour gradually spreads throughout the jar. This process is known as:
- A Atomisation

- B Brownian Motion
- C Decrepitation
- D Diffusion
- E Infiltration

QUESTIONS 6-8 refer to the diagram below: Fig.1 shows the chromatograms of some known dyes. Fig.2 shows the chromatogram of black ink.

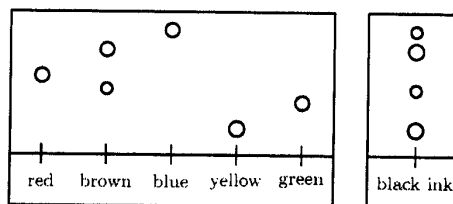


Fig. 1

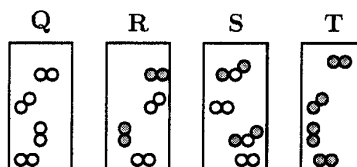
Fig. 2

- 6 Which dyes are present in the black ink?
- A yellow, green, blue
 - B yellow, green, brown
 - C green, brown, blue
 - D yellow, brown, blue
 - E yellow, red, brown, blue
- 7 Which dye is/are most probably pure?
- A red
 - B black
 - C brown
 - D brown and black
 - E red, brown, and black
- 8 Which dye is the most soluble in the stationary phase?
- A red
 - B brown
 - C blue
 - D yellow
 - E green

- 9 When comparing a temperature reading on the Celsius and Kelvin scales which of the following statements is true?
- A 0 K is the same as 0°C.
 - B Both Kelvin and Celsius temperatures can have negative values.
 - C Celsius and Kelvin readings of the same temperature are never numerically equal.
 - D To convert Kelvin to Celsius add 273.
 - E On both scales the temperature can reach infinitely low values.
- 10 72 g of pentane, C_5H_{12} burned completely in oxygen to produce 220 g of CO_2 and 108 g of H_2O . What mass of oxygen was required for this reaction?
- $$C_5H_{12} + 8 O_2 \longrightarrow 5 CO_2 + 6 H_2O$$
- A 1 g
 - B 8 g
 - C 108 g
 - D 220 g
 - E 256 g
- 11 Most of the mass of an atom is occupied by the,
- A nucleus
 - B protons
 - C neutrons
 - D electrons
 - E ions
- 12 Element X is a group II metal in period 3. What would the electron configuration of this element be?
- A 2,8,1
 - B 2,8,2
 - C 2,8,8,2
 - D 2,8,3
 - E 2,3
- 13 A suitable method for obtaining pure water from salt water is
- A precipitation
 - B reverse osmosis

- C centrifuging
- D filtering
- E evaporation

- 14 The diagram below shows a variety of ways in which two different atoms can combine.



Choose the diagram(s) Q, R, S, T which best describes a mixture of an element and a compound.

- A Q only
 - B both R and S
 - C both Q and T
 - D T only
 - E S only
- 15 Which one of the following is most likely to involve a chemical change (chemical reaction)?
- A A certain mineral was heated. It changed from white to yellow. When it cooled it returned to its original white colour.
 - B A white powder was shaken with water. A colourless liquid was formed.
 - C A green solid was heated. It turned black. A gas was evolved which turned limewater milky.
 - D A cold solid quickly vapourized as a white smoke when dropped into boiling water.
 - E Part of a liquid was cooled. A solid formed which sank in the liquid.
- 16 A single covalent bond between two atoms involves
- A one electron
 - B two electrons
 - C three electrons
 - D four electrons
 - E no electrons

QUESTIONS 17-20 refer to the following: Air is a raw material from which several useful substances can be separated. They are separated in the following process.

Dry, carbon dioxide free air is cooled under pressure. Most of the gases liquefy as the temperature falls below -200°C . The liquid mixture is separated by fractional distillation. The boiling points of the gases present are given in the table below:

Gas	Boiling point $^{\circ}\text{C}$
Argon	-186
Helium	-269
Krypton	-157
Neon	-246
Nitrogen	-196
Oxygen	-183

- 17 The most likely reason that the air is dried and the carbon dioxide removed before air is liquefied because
- A no compounds should be present in liquid air.
 - B water vapour and carbon dioxide will solidify at these low temperatures and may block up the tubes.
 - C the water vapour and carbon dioxide react with the components of air
 - D Neither water vapour nor carbon dioxide can be liquefied.
 - E after removing these impurities air is then a pure substance.
- 18 Which of the following gases will not become liquid at -200°C ?
- A Argon
 - B Helium
 - C Oxygen
 - D Nitrogen
 - E Krypton
- 19 Which of the substances in the liquid mixture will be the first to change from liquid to gas as the temperature is slowly increased?
- A Helium
 - B Krypton
 - C Neon
 - D Nitrogen
 - E Oxygen
- 20 Name the physical property associated with these gases on which this separation is based.
- A fractional distillation
 - B condensation
 - C density
 - D boiling point
 - E freezing point
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- 21 Which of the following statements is *not* correct regarding the formation of an ionic bond between magnesium and oxygen?
- A Valence electrons are transferred from a magnesium atom to an oxygen atom.
 - B The properties of magnesium and magnesium oxide are similar.
 - C Energy is released in the formation of magnesium oxide.
 - D The mass of magnesium oxide formed is greater than the mass of magnesium used.
 - E Magnesium oxide contains no molecules.
- 22 Which of the following properties most likely indicates an ionically bonded compound?
- A solid, with a high melting point
 - B colorless liquid
 - C boils at -61°C
 - D nonconducting aqueous solution
 - E reacts slowly in water.
- 23 The following elements are part of the periodic table. Which of the following statements is correct?
- | | | | | | | | |
|----|----|---|---|---|---|---|----|
| Li | Be | B | C | N | O | F | Ne |
|----|----|---|---|---|---|---|----|
- A These elements are in period 1 of the periodic table.

- B These elements are in period 2 of the periodic table.
- C The valency of these elements increase in steps of 1 as you move across them from left to right.
- D These are the alkaline-earth metals.
- E These elements are in group 2 of the periodic table.
- 24 Which of the following statements is *not* true of molecules in the gaseous state according to the kinetic theory of gases?
- A Molecules show rapid, random motion.
- B Attractions between molecules is negligible.
- C Molecules of different gases have the same average kinetic energy at the same temperature.
- D Molecules move in straight-line paths between collisions.
- E All the molecules in a gas move at the same speed.

QUESTIONS 25-27 refers to the behaviour of the indicators listed below:

Indicator	Colour
methyl red	red, below pH 5 yellow, above pH 5
bromthymol blue	yellow, below pH 7 blue, above pH 7
phenolphthalein	colourless, below pH 9 pink, above pH 9

- 25 Egg white has a pH of approximately 7.9. If bromthymol blue and phenolphthalein indicator are both added to egg white, the resulting colour will be
- A blue
- B pink
- C red
- D colourless
- E yellow
- 26 What colour would you expect bromthymol blue to be in a solution having a pH of exactly 7?

- A blue
- B yellow
- C red
- D green
- E colourless

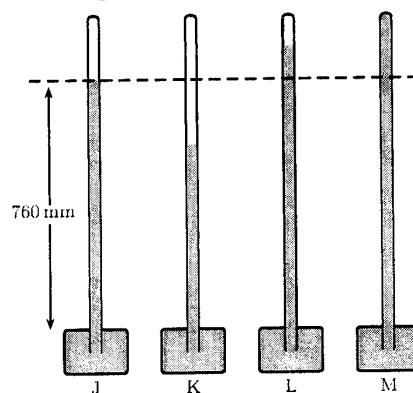
- 27 Sodium metal is added to water. After reaction is complete a few drops of bromthymol blue are added to the resulting solution. What is the observed color of the solution?

- A green
- B blue
- C red
- D yellow
- E no colour change

- 28 Oxygen gas may be identified by its ability:

- A To relight a glowing splint.
- B To turn limewater milky.
- C To turn red litmus paper blue.
- D To form a white smoke with nitrogen gas.
- E To extinguish a lighted splint.

- 29 The figure below shows four identical mercury manometers. Manometer J indicates the reading at sea level. Which manometer shows a likely reading on top of Mount Everest?



- A J
- B K
- C L
- D M
- E not possible to determine.

SECTION B: SHORT ANSWER QUESTIONS

Answer **EACH OF THE FOLLOWING FIVE QUESTIONS** in the space provided on your question paper. *This section is worth 56 marks.* In numerical questions, indicate clearly how you arrive at your answers.

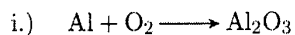
1 (a) Write the chemical formula for each of the following substances: (4 MARKS)

- i.) iron(II) sulphide
- ii.) ammonium carbonate
- iii.) sodium hydrogencarbonate
- iv.) aluminium sulphate

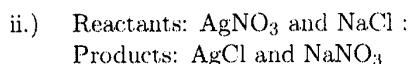
(b) Write the name of each of the following: (4 MARKS)

- i.) BN
- ii.) $\text{Cu}(\text{NO}_3)_2$
- iii.) NH_4Cl
- iv.) FeBr_3

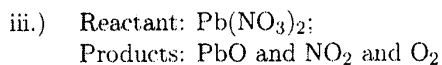
(c) Write balanced chemical equations in each of the following cases: (4 MARKS)



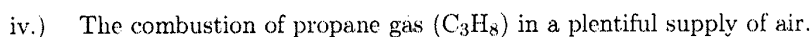
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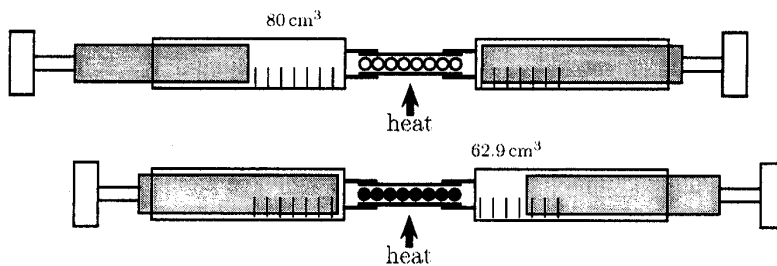


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- 2 The apparatus below was used to estimate the percentage of oxygen gas in the air. 80 cm³ of dry air was placed in the apparatus at 25 °C. The air was passed backwards and forwards over heated copper until no further change in volume took place. The hot copper reacts with the oxygen in the air as follows: $2\text{Cu(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{CuO(s)}$. The apparatus was then allowed to cool down to 25 °C again and the final volume reading (62.9 cm³) was taken.



During the experiment the *pink copper metal slowly turned black*.

- (a) Why was the apparatus allowed to cool back to 25 °C before the final volume reading was taken? (1 MARK)

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- (b) i.) Briefly explain why there was a change in volume. (2 MARKS)

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- ii.) What experimental observation supports your explanation for the change in volume? (1 MARK)

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- (c) Calculate the percentage of oxygen in air by volume. (1 MARK)

- (d) Give the name of the main gas remaining in the syringe at the end of the experiment. (1 MARK)

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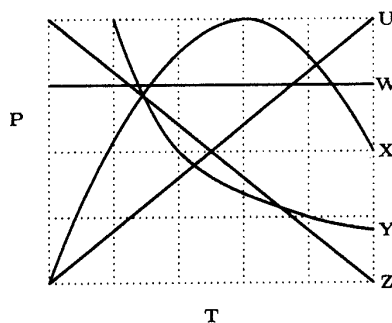
- (e) Would you expect the mass of solid copper to have increased or decreased during the experiment? Explain. (2 MARKS)

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3. Amonton's (Gay-Lussac's) Law is sometimes stated as:
"The pressure **P** of a fixed mass of gas at a constant volume is directly proportional to the Kelvin temperature **T**".

(a) Write a mathematical expression for this relationship between pressure and temperature. (1 MARK)

(b) Which of the graphs below U, W, X, Y, Z shows the correct relationship between the pressure and Kelvin temperature of a gas at a fixed volume? (1 MARK)
(circle the appropriate letter on the graph below)



(c) An automobile tire has a pressure of 1.43 atm at a temperature of 18°C. After travelling at high speed, the tire pressure reads 1.84 atm. What is the new tire temperature in degrees Celsius? Assume the tire volume remains constant. (3 MARKS)

(d) In terms of the kinetic theory of gases explain **why** the pressure of a gas increases as the temperature increases at constant volume. (3 MARKS)

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4 The following table outlines some of the different methods of preparing salts.

Reaction	Method of Preparation	Example of salt prepared
A	Alkali and acid	sodium sulphate
B	Metal and acid	magnesium chloride
C	Insoluble basic oxide and acid	copper(II) sulphate
D	Insoluble carbonate and acid	zinc(II) nitrate
E	Precipitation	calcium sulphate

(a) For each of the reactions in the table, name two substances which can be used to prepare the salt according to the method given. (10 MARKS)

Reaction Two substances used in the preparation of salt

A and

B and

C and

D and

E and

(b) For reaction A, the same two substances used to prepare sodium sulphate may have resulted in a different salt. Name this salt and give its chemical formula. (2 MARKS)

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(c) i.) Write the balanced chemical equation for reaction B and reaction E, including all physical states. (2 MARKS)

Reaction Balanced chemical equation

B

E

ii.) Write the balanced net ionic equation for both of these reactions, including all physical states. (2 MARKS)

Reaction Net ionic equation

B

E

5 (a) Complete the following table with reference to the periodic table. (7 MARKS)

Name of Element	Mass number	No. of Protons	No. of Neutrons	No. of Electrons	$\frac{A}{Z}X^{\text{charge}}$	Electron Config'n
					${}^{32}_{16}\text{S}^{2-}$	
	2		1			0
sodium	23	11				

(b) The relative abundance of the isotopes in a sample of gallium (Ga) are: 60% ${}^{69}_{31}\text{Ga}$ and 40% ${}^{71}_{31}\text{Ga}$.

i.) Explain what you understand by the term isotope, with specific reference to this example. (2 MARKS)

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ii.) Calculate the relative atomic mass of Gallium in this sample. (2 MARKS)

(c) Explain the meaning of the term isoelectronic. (1 MARK)

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'END OF EXAMINATION'