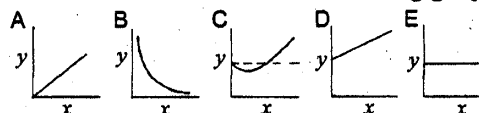


SECTION I: Multiple Choice Questions

Select the SINGLE best alternative in each of the following cases and indicate your answer by marking the corresponding letter on the answer sheet provided according to the instructions thereon. Use a soft pencil so that you may make corrections easily. There is one mark for each question in this section. You may need to consult the copy of the periodic table that is supplied with your question paper.

- 1) An isotope of the element calcium, symbol Ca, has 20 protons and 19 neutrons in the nucleus. The symbol for this isotope may be written:
- A ${}^{39}_{20}\text{Ca}$ ₃₉
- B ${}^{19}_{20}\text{Ca}$
- C ${}^{20}_{19}\text{Ca}$
- D ${}^{39}_{20}\text{Ca}$
- E ${}^{39}_{40}\text{Ca}$
- 2) If a neutral atom has a neutron number of 1 and a proton number of 2, how many electrons surround the nucleus?
- A 1
- B 2
- C 4
- D 8
- E 0
- 3) Boron has two naturally occurring isotopes with mass numbers of 10 and 11. The relative atomic mass of boron must therefore be:
- A Exactly 10.
- B Exactly 11.
- C Between 10 and 11.
- D Less than 10.
- E Exactly 110.
- 4) The formula P₄ represents:
- A An element.
- B A compound.
- C A mixture.
- D A solution.
- E An atom.
- 5) Which one of the following is an element?
- A Wood
- B Sugar
- C Ice
- D Liquid oxygen
- E Steam
- 6) Lead(II) iodide is an insoluble salt. Which one of the following reactions would be most useful for preparing it? (Lead carbonate and lead hydroxide are insoluble.)
- A Partner exchange
- B Reaction of a suitable acid with lead metal.
- C Titration of an acid with an alkali.
- D Treatment of solid lead hydroxide with a suitable acid.
- E Treatment of solid lead carbonate with a suitable acid.
- 7) The full ionic formula of sodium chloride is:
- A NaCl
- B NaCl⁻
- C Na⁺Cl⁻
- D Na⁺Cl
- E Na⁻Cl⁺
- 8) An empirical formula shows
- A how many of each type of atom are present in one molecule.
- B how many atoms are present in the substance.
- C how the atoms in a molecule are connected together.
- D the ratio of numbers of atoms present in a compound in its lowest terms.
- E the precise identity of a compound.

Questions 9 to 11 involve the following graphs:



- 9) Which one of the above graphs best shows the dependence of V (volume) on p (pressure) for a gas at constant temperature?
- 10) Which one of the above graphs best shows the dependence of V (volume) on T (Kelvin temperature) for a gas at constant pressure?
- 11) Which one of the above graphs best shows the dependence of V (volume) on $1/p$ (the inverse of pressure) for a gas at constant temperature?

CONTINUED OVERLEAF

- 12) Sulfur and hydrogen are both substances which consist of molecules. Sulfur melts at 115°C and hydrogen melts at -259°C . The forces of attraction between the molecules must therefore be:
- A Much weaker in sulfur than in hydrogen
 - B A little stronger in sulfur than in hydrogen.
 - C Almost equally strong in both hydrogen and sulfur.
 - D Almost equally weak in both hydrogen and sulfur.
 - E Much stronger in sulfur than in hydrogen.
- 13) A single covalent bond between two atoms involves:
- A one electron.
 - B two electrons.
 - C three electrons.
 - D four electrons.
 - E no electrons.
- 14) The inner shell of an atom generally contains:
- A 2 electrons.
 - B 4 electrons.
 - C 6 electrons.
 - D 8 electrons.
 - E no fixed number of electrons.
- 15) An atom normally becomes an ion by:
- A losing or gaining neutrons.
 - B losing or gaining protons.
 - C losing or gaining electrons.
 - D losing or gaining mass.
 - E losing or gaining volume.
- 16) The relative atomic mass of lead is 207. This means that an atom of lead
- A is 207 times as heavy as an atom of hydrogen.
 - B is 207 times as heavy as an atom of carbon.
 - C is 207 times as large as an atom of hydrogen.
 - D is 207 times as large as an atom of carbon.
 - E contains 207 particles.
- 17) Ionic compounds are usually:
- A Solids with low melting point.
 - B Solids with high melting point.
 - C Liquids with low boiling point.
 - D Liquids with a fairly high boiling point.
 - E Gases at room temperature.
- 18) Which is the "odd man out" amongst the following substances in terms of the bonding involved?
- A Sodium chloride.
 - B Water.
 - C Ammonia.
 - D Carbon dioxide.
 - E Methane
- 19) The electronic structure of carbon is:
- A 2.8.6
 - B 2.6
 - C 2.8
 - D 2.4
 - E 2.8.4
- 20) Which one of the following particles is the lightest?
- A Atom
 - B Electron
 - C Neutron
 - D Proton
 - E Molecule
- 21) A particle containing 1 proton, 1 neutron and 1 electron is
- A a carbon atom
 - B a sodium ion
 - C a hydrogen atom
 - D a hydrogen ion
 - E a helium atom
- 22) At 300K a certain sample of gas occupies 1dm^3 . At 600K and the same pressure the same mass of gas would occupy:
- A 0.5 dm^3
 - B 600 dm^3
 - C 2 dm^3
 - D 300 dm^3
 - E 301 dm^3
- 23) 300°C is the same as
- A 27K
 - B 273K
 - C 573K
 - D 0K
 - E -300K
- 24) Standard temperature and pressure (s.t.p.) are:
- A 760K and 273 atm
 - B 0°C and 273 atm
 - C 273°C and 760 atm
 - D 273K and 0 atm
 - E 273K and 1 atm

CONTINUED OVERLEAF

- 25) The law of Multiple Proportions is concerned with:
- A Several compounds containing different elements.
 - B Two compounds each containing more than two elements.
 - C Several samples of the same compound.
 - D Several elements containing different molecules.
 - E Several compounds containing the same elements.
- 26) 100g of an element X combine with 50g of an element Y in one sample of a compound. In another sample of the same compound 200g of element X combine with:
- A 100g of Y.
 - B 150g of Y
 - C 25g of Y
 - D 200g of Y
 - E 50g of Y
- 27) Which one of the following is most likely to involve a chemical reaction (chemical change)?
- 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 lime water milky.
 - D A mixture of boiling point 85°C was distilled. The distillate was collected and found to be a liquid of boiling point 65°C .
 - E A yellow powder was heated in the absence of air. It melted to a yellow liquid which darkened on further heating. When cooled this liquid formed a black solid mass which could be ground to a yellow powder.
- 28) Nitrogen dioxide gas may be identified because:
- A it relights a glowing splint.
 - B it turns lime-water milky.
 - C it turns red litmus paper blue.
 - D it is brown.
 - E it burns with a pop.
- 29) A solution
- A contains particles which can be removed by filtration.
 - B may be described as a homogeneous mixture.
 - C is generally cloudy in appearance.
 - D always contains water.
 - E is always colourless.
- 30) An ideal gas is one which:
- A Has a simple formula.
 - B Is colourless.
 - C Obeys the gas laws perfectly.
 - D Has a very low density.
 - E Is easily liquefied by the application of pressure.
- 31) The valency of an element X is 3 and of element Y is 4. A compound of X and Y would be expected to have the formula:
- A XY
 - B X_2Y
 - C X_3Y_4
 - D X_3Y
 - E X_4Y_3
- 32) Copper(II) sulfate is so-called *because*
- A It contains two copper atoms.
 - B The valency of copper is 2.
 - C It contains twice as much copper as sulfate.
 - D The relative atomic mass of copper is 2.
 - E The sulfate ion has a charge of 2-.
- 33) A porcelain boat was weighed and its mass recorded as 2.34g. After filling with copper(II) oxide its mass was 7.68g. This value decreased to 6.61g after heating the boat and its contents in a stream of propane gas. The mass of copper in the copper(II) oxide was:
- A 5.34g
 - B 4.27g
 - C 1.07g
 - D 6.61g
 - E 7.68g

- 34) Charles's law states that
- A the volume of a given mass of gas is inversely proportional to its temperature if the temperature remains constant.
 - B the volume of a given mass of gas is proportional to its Kelvin temperature if the pressure remains constant.
 - C the relative molecular mass of a gas is twice its vapour pressure.
 - D the volume occupied by any gas at s.t.p. is 22.4 dm^3 .
 - E the mass of a given volume of gas is inversely proportional to its pressure providing the temperature remains constant.
- 35) The charge on the nucleus of an atom is determined by
- A the number of electrons in the nucleus.
 - B the number of neutrons in the nucleus.
 - C the mass of the nucleus.
 - D the number of atoms in the nucleus.
 - E the number of protons in the nucleus.

SECTION II: SHORT ANSWER QUESTIONS

Answer the following questions in the spaces provided on the question paper. You may need to consult the copy of the periodic table that is supplied with your question paper. Answers to numerical questions must be supported by working, must be expressed to an appropriate number of significant figures and must include units where appropriate.

- 1) Fill in the blanks in the following passage with a **SINGLE** appropriate word in each case. The words you select must complete the sentences grammatically. ***Read the whole passage carefully before you insert any words.*** (8 marks)

When sulfur powder and iron powder are shaken together at room temperature a grey substance is formed. This is a _____ of iron and sulfur. On the other hand, if the two are heated strongly in a test tube the mixture ignites and a glow is seen to spread throughout the mass. The sulfur and iron _____ with each other and the result is a _____ of sulfur and iron called iron(II) sulfide. When this substance is treated with dilute hydrochloric acid it gives off a gas which smells of rotten eggs. This is a chemical _____ of the substance which is quite different from those of the original iron and sulfur. This is one of the reasons for saying that the process observed in the heated test tube is a _____ rather than a _____ change. Another reason for saying this is that during the change a great deal of _____ is given out. While the original sulfur and iron may be separated easily, after heating together much more vigorous methods are required to separate them: the change may be described as difficult to _____.

CONTINUED OVERLEAF

- 2) Fill in the blank spaces in the following table. (7 marks)

SYMBOL OF ATOM OR ION	NAME OF ELEMENT	MASS NUMBER	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS	ELECTRONIC CONFIG'N
${}^7\text{Li}^+$			3			
Ne				12		2, 8
${}^{37}\text{Cl}^-$				20		

- 3) The electronic structure of sodium is 2,8,1; of fluorine is 2,7; and of hydrogen is 1.
- a) Draw electron dot and cross diagrams to show the electronic changes which occur when sodium fluoride (NaF) is formed from atoms of its elements. Show ALL electrons and shells. Label the following features: nucleus, electron, electron shell, cation, anion. (4½ marks)
- b) Draw electron and cross diagrams to show the electronic changes which occur when hydrogen fluoride (HF) is formed from atoms of its elements. Show ALL electrons and electron shells. Label the following features: bonding pair of electrons, non-bonding pair (ie. lone pair), molecule, free atom. (3½ marks)

CONTINUED OVERLEAF

4) a) Write down the chemical formula of each of the following compounds:

(3 marks)

i) lithium chloride _____

ii) potassium carbonate _____

iii) lead(IV) oxide _____

b) Write down a correct chemical name for each of the following compounds:

(3 marks)

i) Cu_2SO_4 _____

ii) NH_3 _____

iii) NaNO_3 _____

5) Briefly explain the following observations in terms of the kinetic theory of matter.

a) Liquids and gases flow whereas solids do not.

(3 marks)

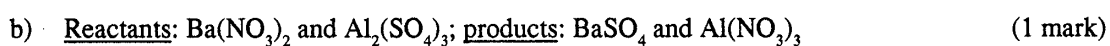
b) Gases are much less dense than either solids or liquids.

(3 marks)

6) A sample of carbon dioxide gas occupies a volume of 2dm^3 at 27°C and 1140mmHg pressure. What would be the volume of the gas at -10°C and 760mmHg ? (3 marks)

CONTINUED OVERLEAF

7) Write balanced chemical equations in each of the following cases:



d) The combustion of hydrogen to form water (2 mark)

8) Three tubes labelled A, B, and C each contain white powder. Each of the powders melts at 110°C .
When the powders from tubes A and B are mixed, the mixture melts at 110°C . When the powders from A and C are mixed this mixture melts over a range of temperature, from 90 to 160°C .

a) What can you say about the identities and purities of the substances in the tubes? (3 marks)

b) What can you say about the expected melting behaviour of a mixture of the powders from the tubes B and C? (1 mark)

THIS IS THE END OF THE PAPER. GO BACK AND CHECK YOUR WORK.