

K.C.S.E CHEMISTRY PAPER 233/1 2001

1. Study the nuclear reactions given in the scheme below and answer the questions that follow.



a) $^{12}_{\text{C}}$ and $^{14}_{\text{C}}$ are isotopes. What is meant by the term isotope? (1 mark)

b) Write an equation for the nuclear reaction in Step II (1 mark)

c) Give one use of $^{14}_{\text{C}}$ (1 mark)

2. In an experiment, 0.8g of magnesium powder were reacted with excess dilute sulphuric acid at 25°C. The time for the reaction to come to completion was recorded. The experiment was repeated at 40°C. In which experiment was the time taken shorter? Explain your answer. (3 marks)

3. The electronic structures for elements represented by letters A, B, C and D are

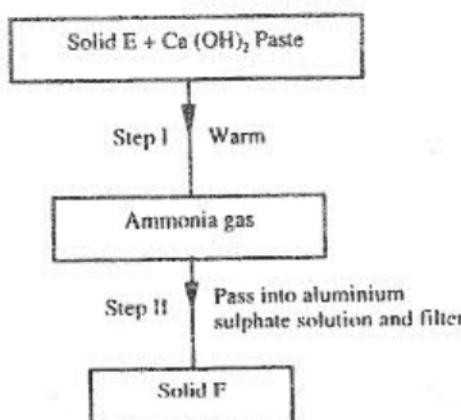
A 2.8.6; B 2.8.2; C 2.8.1; D 2.8.8.

a) Select the elements which forms:
i) a double charged cation (1 mark)

ii) a soluble carbonate (1 mark)

b) Which element has the shortest atomic radius? (1 mark)

4. Study the scheme below and answer the questions that follow



a) Identify solid E (1 mark)

- b) Write an ionic equation for the reaction in step II that produces solid F (1 mark)
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5. Give reason why phosphorus is stored under water (1 mark)
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6. At 289K and 1 atmosphere pressure, graphite changes into diamond according to the equation:
 $C(\text{graphite}) \rightarrow C(\text{diamond}); \Delta H = 2.9 \text{ kJ mol}^{-1}$
In the space provided, sketch a simple energy level diagram for the above change. (2 marks)
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7. How would you obtain a sample of pure iodine from a mixture of iodine and lead sulphate? (2 marks)
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8. 10g of sodium hydrogen carbonate were dissolved in 20cm³ of water in a boiling tube. Lemon juice was then added dropwise with shaking until there was not further observable change.
- a) Explain the observation which was made in the boiling tube when the reaction was in progress
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- b) What observation would have been made if the lemon juice had been added to copper turnings in a boiling tube? Give a reason (1 mark)
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9. Sample solutions of salt were labelled as I, II, III and IV. The actual solutions, not in that order, are lead nitrate, zinc sulphate, potassium chloride and calcium chloride.
- a) When aqueous sodium carbonate was added to each sample separately, a white precipitate was formed in I, III and IV only. Identify solution II. (1 mark)
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- b) When excess aqueous sodium hydroxide was added to each sample separately, a white precipitate was formed in III only. Identify solution III. (1 mark)
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- c) When dilute sulphuric acid was added separately to each sample, a white precipitate was formed in solutions I and III only. Identify solution I. (1 mark)
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10. A weighed sample of crystalline sodium carbonate, $(\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O})$ was heated in a crucible until there was no further change in mass. The mass of the sample reduced by 14.5%. Calculate the number of moles (n) of the water of crystallisation.
(Na = 23, O = 16, C = 12 H = 1) (3 marks)

11. A certain match stick head contains potassium chlorate and sulphur. On striking, the two substances react to produce sulphur dioxide and potassium chloride. Explain the environmental effect of using such matches in large numbers. (2 marks)

12. Describe a simple laboratory experiment that can be used to distinguish between sodium sulphide and sodium carbonate. (3 marks)

13. The information in the table below relates to elements in the same group of the period table. Study it and answer the questions that follows:

Element	Atomic size
G1	0.19
G2	0.23
G3	0.15

Which element has the highest ionisation energy? Give a reason (3 marks)

14. When the oxide of element H was heated with powdered carbon, the mixture glowed and carbon dioxide gas was formed. When the experiment was repeated using the oxide of element J, there was no apparent reaction.

a) Suggest one method that can be used to extract element J from its oxide. (1 mark)

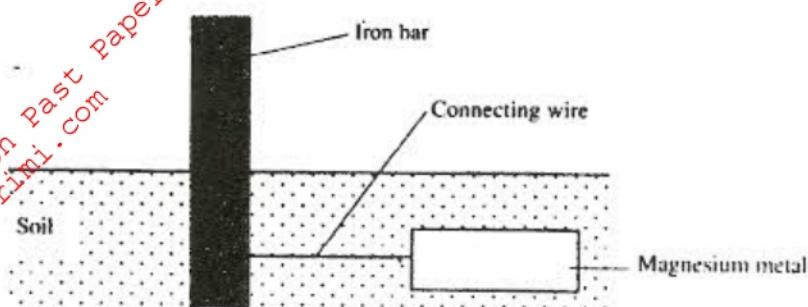
b) Arrange the elements H, J and carbon in the order of their decreasing reactivity (1 mark)

15. When a sample of concentrated sulphuric acid was left in an open beaker in a room for two days, the volume was found to have increased slightly.

a) What property of concentrated sulphuric acid is shown by the above reaction? (1 mark)

b) State one use of concentrated sulphuric acid that depends on the property named above. (1 mark)

16. The diagram below shows an iron bar which supports a bridge. The iron bar is connected to a piece of magnesium metal.



Explain why it is necessary to connect the piece of magnesium metal to the iron bar (3 marks)

17. a) State one cause of temporary hardness in water (1 mark)

- b) How does distillation remove hardness from water? (2 marks)

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18. In the presence of U.V light, ethane gas undergoes substitution reaction with chlorine

- a) What is meant by the term:
Substitution reaction? (1 mark)

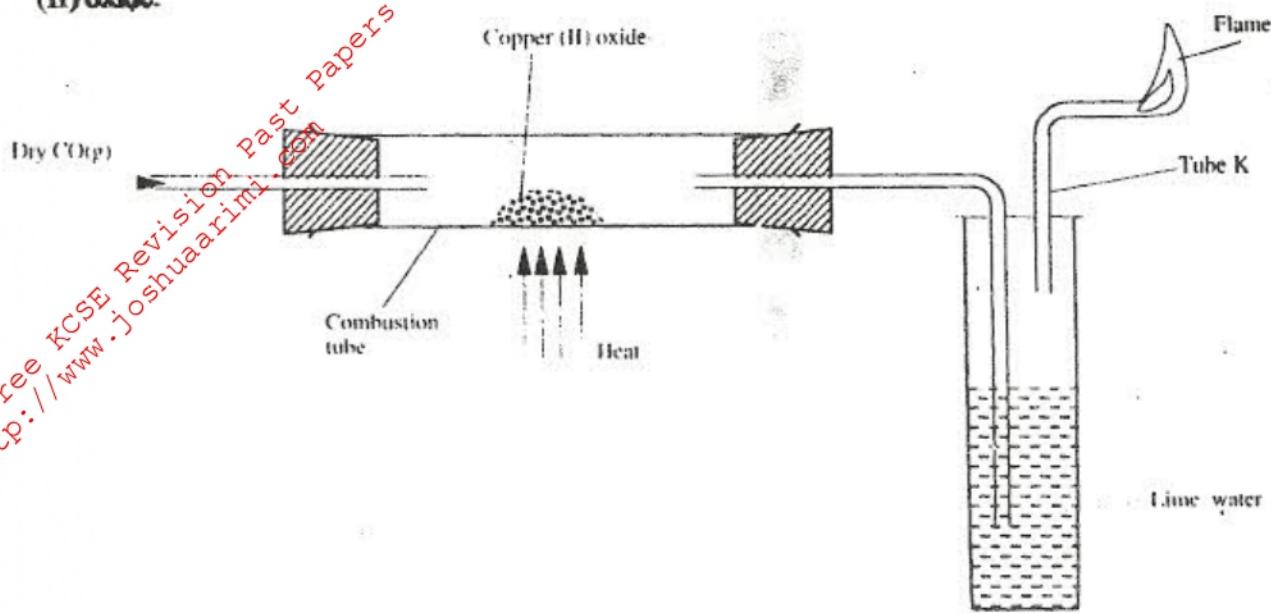
- b) Give the structural formula and the name of the organic product formed when equal volumes of ethane and chlorine react together. (2 marks)

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19. Explain why burning magnesium continues to burn in a gas jar full of sulphur dioxide while a burning splint would be extinguished. (3 marks)

20. a) What observations would be made if hydrogen sulphide gas was bubbled through a solution of zinc nitrate? (1 mark)

- b) Write an equation for the reaction that takes place in (a) above. (1 mark)

21. The apparatus shown below was used to investigate the effect of carbon monoxide on copper (II) oxide.



- a) State the observation that was made in the combustion tube at the end of the experiment (1 mark)
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- b) Write an equation for the reaction that took place in the combustion tube. (1 mark)
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- c) Why is it necessary to burn the gas coming out of tube K? (1 mark)
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22. Explain why hydrogen forms compounds in which its oxidation state is either +1 or -1.
(Atomic number of hydrogen is 1) (3 marks)
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23. The table below shows the properties of substances K,L,M and N.

Substances	Reaction with oxygen at 25°C	Melting point	Conductivity	
			Solid	Molten
K	Unreactive	Low	Poor	Poor
L	Reactive			
M	Unreactive	High	Good	Good
N	Unreactive	Low	Good	Good

Select the substance which is likely to be:

- a) Copper metal (1 mark)
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- b) Magnesium chloride (1 mark)

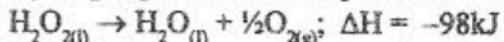
24. An element P has a relative atomic mass of 88. When a current of 0.5 amperes was passed through the fused chloride of P for 32 minutes and 10 seconds, 0.44g of P were deposited at the cathode.

Determine the charge on an ion of P (1 Faraday = 96500 Coulombs) (3 marks)

25. The melting point of phosphorus trichloride is -91°C . while that of magnesium chloride is 715°C . In terms of structure and bonding, explain the difference in their melting points. (3 marks)
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26. The pH of a sample of soil was found to be 5.0. An agricultural officer recommended the addition of calcium oxide in the soil (2 marks)
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27. Hydrogen peroxide decomposes according to the equation given below.



8.5 of hydrogen peroxide contained in 100cm³ of solution with water were completely decomposed.

Determine the rise in temperature due to the reaction.

(Specific heat capacity of water = 4.2Jg⁻¹K⁻¹, density of water = 1g/cm³ O = 16 H = 1)

(3 marks)