CHEMISTRY PAPER 1

ANSWERS

KCSE 2010

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Chemistry Paper 1

1. (a) Deliquescent - a substance that absorbs water from the atmosphere and changes into a solution. (1)

   Hygroscopic – a substance that absorbs water from the atmosphere but just becomes wet. (1)

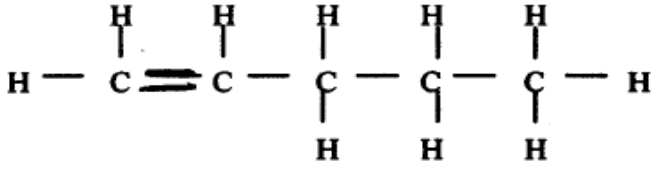
   (b) drying agent. (1) (3 marks)

2. (a) (i) Element – substance that consists of one type of atoms. (1)
   (ii) Atomic number – number of protons in an atom. (1)

   (b) $Ti_3(SO_4)_2$ (1) (3 marks)

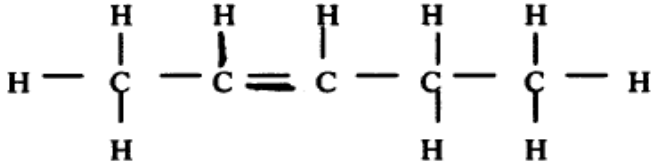
3. (a) ductility. (1)
   (b) activation energy. (1)
   (c) vander waals force. (1) (3 marks)

4.



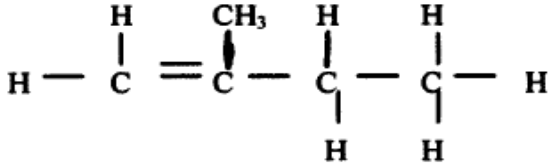
(1)

pent-1-ene



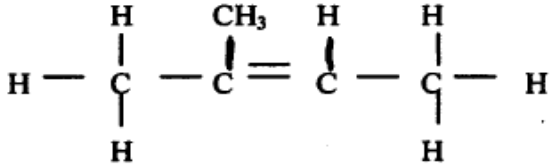
(1)

Pent-2-ene



(1)

2-methylbut-1-ene



2-methylbut-2-ene

5. (a) Heat the hydrated salt in a sealed container (1). The pink substance changes to blue (½). Allow the pink substance to cool (1) it changes to a pink substance (½). (3 marks)

6. (a) $Al_2O_3(s) + 6HCl(aq) \longrightarrow 2AlCl_3(aq) + 3H_20\ (l)$

(b) $Al_20_3 = 2(27) + 3(16) = 102$

Moles of $Al_2O_3 = \frac{153}{102}$ (1)

Moles of HCl = $\frac{152}{102} \times 6$ (½) = 9 moles (½) (3 marks)

7.

Electrolyte	Anode	Cathode
Aqueous sodium sulphate using (½) insert electrodes	Oxygen	Hydrogen (½)
Copper(II) sulphate using copper electrode	Copper ions (1)	Copper metal (1)

(3 marks)

8. (a)

$$\frac{P_1V_1}{T_1} = \frac{p_2V_2}{T_2}$$

$$\frac{1.0\times10^7 \times 1}{77} = \frac{1.0\times10^5 \times V_2}{298} \quad (½)$$

$$V_2 = \frac{1.0\times10^7 \times 298}{1.0\times10^5 \times 77} \quad (½)$$

$$V_2 = 387.0dm^3 \quad (½)$$

(b) No. of moles of

$$N_2 = \frac{387.0}{24.0} = 16.1 \text{ moles } (½)$$

$\therefore$ mass of N_2 = 28 × 16.1 (½)
= 450.8 g (½) (3 marks)

9. (a) $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$ (1 mark)

(b) (i) 5.6×10^3 years (1 mark)
(ii) 78% (1 mark)

10. (a) Enthalpy of formation of hydrogen peroxide (1) (1 mark)

(b)

$$\Delta H_1 + \Delta H_3 = \Delta H_2$$
$$= \Delta H_2 + \Delta H_1$$
$$= 187.8 - 285.8\ (1)$$
$$= -98\,kJmol^{-1}\ (1)$$

(2 marks)

11. (a) Iron (II) Sulphide
Hydrochloric acid (1)

(b) Reducing agent, hydrogen sulphide (½)
The sulphur changes from -2 to zero (½)

(c) Vulcanisation of rubber (1)
Manufacture of sulphur drugs (3 marks)

12. (a) $Cu^{2+}_{(aq)} + Fe_{(s)} \longrightarrow Cu_{(s)} + Fe^{2+}_{(aq)}$ (1)

(b)

$$\Delta H = MC\Delta T$$
$$= 75.0 \times 4.2 \times 5.6 \quad (½)$$
$$= {}^{-}1764J$$

$$\text{Moles of Cu} = \frac{5.83}{63.5} = 0.0918 \quad (½)$$

$$\Delta H/\text{mol} = \frac{1764}{0.0918} \quad (½)$$

$$= {}^{-}19215.7J$$
$$= {}^{-}19.2kJ\,mol \quad (½)$$

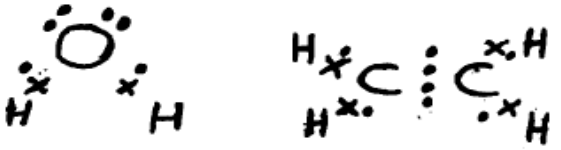
(3 marks)

13. (a)

Reagents	Conditions
Hydrogen (1)	High temperature (½) High pressure Nickel catalyst (½)

(b) Soap = Sodium hydroxide (½) Heating (½) (3 marks)

14. (a)



(b) Dative covalent bond (1) (3 marks)

15. (a) gas has no colour and smell. (1)

(b) Carbon (II) oxide has high affinity for iron in the haemoglobin in the blood, or displaces oxygen from haemoglobin, (1) the body tissues are deprived of oxygen. (1)

(3 marks)

16. (a) Add a few drops of NaOH to an aqueous solution of the fertilizer. Forms white ppt insoluble in excess. (1)

Add a few drops of aqueous sulphuric (VI) acid to another portion of aqueous solution of fertilizer. Forms a white ppt insoluble in excess. (1)

(b) Heat the sample fertilizer in a test tube, and test gas evolved with damp red litmus paper, turn blue. (1)

Or add NaOH to the sample fertilizer and heat the mixture; test gas evolved using damp red litmus paper, turn blue. (3 marks)

17. (a)

	C	H	O	
%	69.42	4.13	26.45	(½)
	$\frac{69.42}{12} = 5.785$	$\frac{4.13}{1} = 4.13$	$\frac{26.45}{16} = 1.653$	(½)
Simplification	$\frac{5.785}{1.653} = 3.5$	$\frac{4.13}{1.653} = 2.5$	$\frac{1.653}{1.653} = 1$	(½)
Whole no.	7	5	2	(½)

Empirical formula $C_7H_5O_2$ (½)

(3 marks)

(b) Empirical mass $7(12) + 5(1) + 2(16)$ (½)
$= 121$

$(C_7H_5O_2)n = 242$
$(121)n = 242$
$n = \frac{242}{121} = 2$

Molecular formula is $C_{14}H_{10}O_4$ (½) (3 marks)

18. (a) $X = H_2$ gas (1 mark)
(b) Increase surface area for faster reaction. (1 mark)
(c) Pickling of metals. (1 mark)

19. (a) $2H_2 + O_2 \rightleftharpoons 2H_2O$ (1 mark)

(b) e.m.f. = 0.40 − ¯0.83 = 1.23V per cell.
For ten cells = 10 x 1.23 = 12.3V (1)

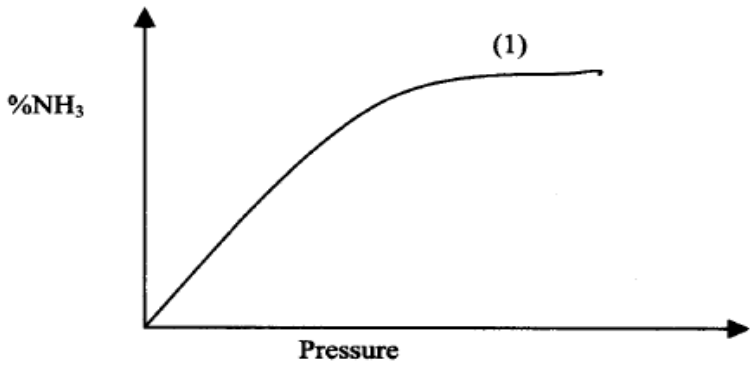
(c) Water formed can be used.
Water is not a pollutant. (1) (3 marks)

20. (a) $NH_4NO_3(s) \longrightarrow N_2O_{(g)} + 2H_2O_{(g)}$ (1)
(b) Downward displacement of warm water because it is fairly soluble in cold water (1)
(c) Both red and blue litmus will not change colour. (1) (3 marks)

21. (a) Chlorofluorocarbon (1)
(b) When ozone is depleted, high energy UV radiations reach the earth, which may cause skin cancer to human beings. (1)
(c) Global warmings (1), /green house effect. (3 marks)

22. (a) Forward reaction is exothermic, (1) therefore increase in temperature shifts position of equilibrium to the left direction in (1) which heat is absorbed.

(b)



(3 marks)

23. Hydrochloric acid is a strong acid which is fully ionised in water (1) while ethanoic acid is a weak acid, partially ionised in water. (1) (2 marks)

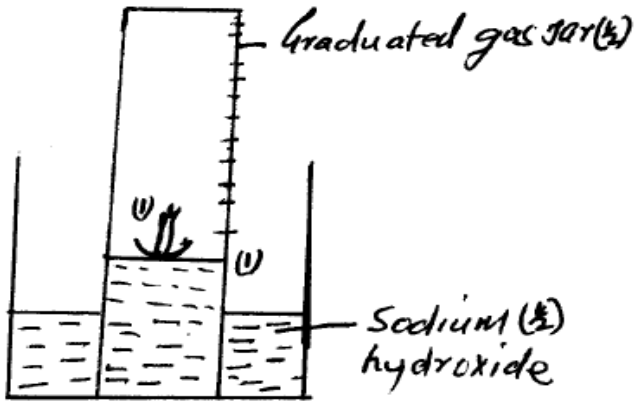
24. React ion metal with sulphuric acid to form Iron (II) sulphate. (1)
React aqueous ammonia with sulphuric acid to form Ammonium Sulphate. ½
Mix the two solutions iron (II) Sulphate and ammonium sulphate ½ to form a solution of ammonium iron (II) sulphate evaporate, ½ until crystallization ½ starts then filter.½
(3 marks)

25.

	Inference	
1st portion	water hard	(1)
2nd portion	permanent hardness of water	(1)
3rd portion	Na_2CO_3 removed the hardness	(1)

(3 marks)

26.



27. (a) 2.8.8 (1)
(b) $K^+ < S^{2-} < P^{3-}$ (1)
Potassium has 19 protons attracting 18 electrons, sulphur has 16 protons attracting 18 electrons and phosphorous has 15 protons attracting 18 electrons.
Therefore the electrons in potassium ions are attracted more strongly making it the smallest ion (1)
(3 marks)