NAME_____ SCHOOL ------------------------------

SCHOOL ------------------------------

ADM NO ----------------------------

SIGNATURE ------------------------

DATE --------------------------------

233/1
FORM 4
CHEMISTRY
PAPER 1

TIME: 2 HOURS

SCHOOL BASED FORM 4 EXAMINATION JULY-AUGUST 2017

FORM FOUR

INSTRUCTIONS

1. Write your name and admission number in the space provided above.

2. Sign and write the date of examination in the space provided above.

3. Answer ALL the questions in the spaces in the questions.

4. ALL working must be clearly shown where necessary.

5. KNEC Mathematical tables and silent electronic calculators may be used.

6. Candidates should answer the questions in English language.

For Examiner's use only

Questions	Maximum Score	Candidate's score
1 – 29	80	

1. Draw the structures and give the names of three alkane having molecular formula C_5H_{12} (3mks)

   _____
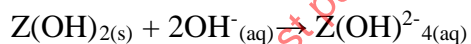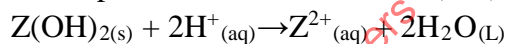
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2. The table below shows three isotopes of element neon. Study it and answer the questions that follow;

Mass number of Isotope	Percentage abundance (%)
20	90.9
21	0.3
22	8.8

   a)   What are isotopes   (1mk)

   _____

   _____

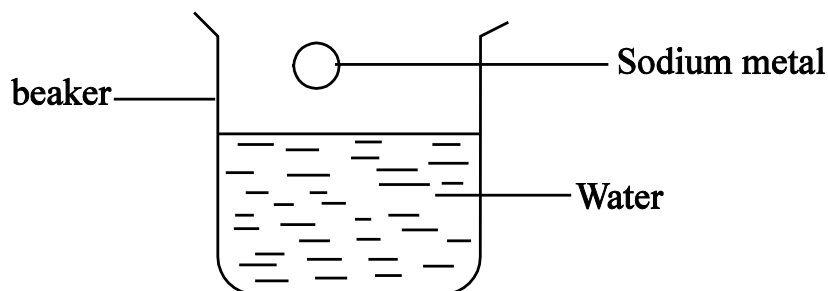   b)   Calculate the relative atomic mass of an atom of neon.   (2mks)

   _____

   _____

   _____

   _____

   _____

3.   A compound whose formula is $Z(OH)_2$ reacts as shown below;
     $$Z(OH)_{2(s)} + 2H^+_{(aq)} \rightarrow Z^{2+}_{(aq)} + 2H_2O_{(L)}$$

     $$Z(OH)_{2(s)} + 2OH^-_{(aq)} \rightarrow Z(OH)^{2-}_{4(aq)}$$

   a)   State the property exhibited by $Z(OH)_2$ (1mk)

   _____

   _____

   ii)   Name two hydroxide that behave like $Z(OH)_2$ (2mks)

   _____

   _____

4. The diagram below shows sodium metal being dropped in water. Study it and answer the questions that follow;

i) State and explain two observations made during the reaction. (2mks)

_____

_____

ii) Write an equation for the reaction that takes place during the experiment. (1mk)

_____

5. State two advantages of drinking hard water than soft water. (2mks)

_____

_____

6. A gas occupies $0.4dm^3$ at 20^0c and 1.0 x 10^3Pascals what will be the temperature of the gas when the volume and pressure of the gas when the volume and pressure of the gas is $0.1dm^3$ and 1.0 x 10^3Pascals respectively. (3mks)

_____

_____

_____

7. (i) On complete combustion of a hydrocarbon 0.88g of carbon (iv) oxide and 0.36g of water were formed (i) calculate the molecular formula of the hydrocarbon given that relative molecular mass of the hydrocarbon is 70. (c = 12, H = 1, O = 16) (2mks)

_____

_____

_____

ii) Draw the structural formular of the hydrocarbon in (i) above (1mk)

8.   The table below shows the observations made when aqueous ammonia was added to cations of elements A, B and C until in excess.

Cation of	Addition of a few drops of aqueous ammonia	Addition of excess aqueous ammonia
A	White precipitate	Dissolves to form a colourless solution
B	Pale blue precipitate	Deep blue solution
C	No precipitate	No precipitate

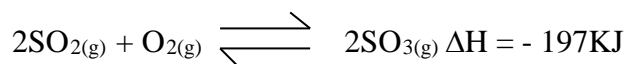   i)   Name the cation present in   (2mks)

   i)   A -

   _____

   ii)   B -

   _____

   ii)   Write the formula of ion present in the deep blue solution.   (1mk)

   _____

9.   The equation below shows the oxidation of sulphur (IV) oxide to sulphur (IV) oxide

   $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ $\Delta H = -197KJ$

   i) Name **two** catalysts for this reaction.   (1mk)

   _____

   ii) State and explain the effect on the yield of sulphur (VI) oxide when;

   I   pressure is reduced   (1mk)

   _____

   _____

   II   temperature is reduced   (1mk)

   _____

   _____

10.   i) Name the bleaching agent formed when chlorine gas reacts with hot concentrated sodium hydroxide solution.   (1mk)

   _____

   ii)   Name another use of the compound in (i) above other than bleaching.   (1mk)

   _____

11. 0.28g of aluminium reacted completely with oxygen gas. Calculate the volume of oxygen used. (molar gas volume is 24000cm^3 Al = 2.7) (3mks)
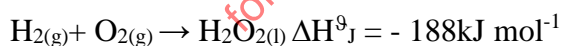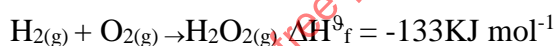
_____

_____

_____

_____

12. Describe you would prepare a pure sample of zinc carbonate starting with zinc oxide. (3mks)

_____

_____

_____

_____

13. Equal volumes of 2m monobasic acids D and E were each reacted with excess magnesium ribbon. The table shows the volumes of gas produced after 2 minutes. (4mks)

Acid	Volume of gas (cm^3)
D	30
E	70

Explain the difference in the volumes of gas produced. (2mks)

_____

_____

14. The thermo chemical equations below shows the formation of hydrogen peroxide under standard conditions;

$H_{2(g)} + O_{2(g)} \rightarrow H_2O_{2(g)}$ $\Delta H^\theta_f = -133KJ\ mol^{-1}$

$H_{2(g)} + O_{2(g)} \rightarrow H_2O_{2(l)}$ $\Delta H^\theta_J = -188kJ\ mol^{-1}$

Calculate the molar heat of vaporization of hydrogen peroxide. (2mks)

_____

_____

_____

15. $50cm^3$ of 1m magnesium sulphate was electrolysed using the set up represented by the diagram below;
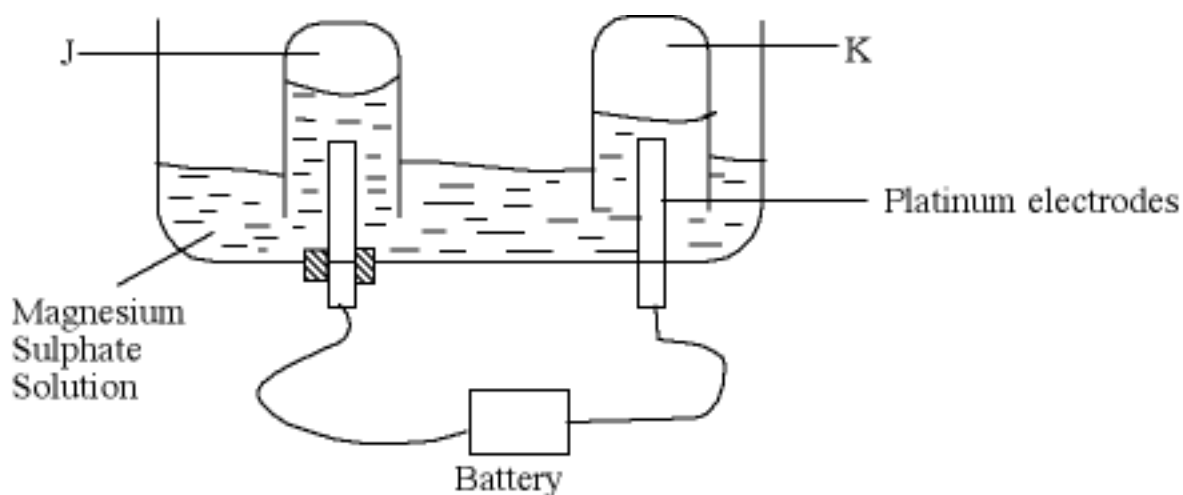
    I   Identify the gas labeled K.   (½ mk)

_____

    II   Write an equation for the reaction that liberates gas J.   (1mk)

_____

    III   What happens to the concentration of the magnesium sulphate during electrolysis.
Explain   (1½mk)

_____

_____

16.   i)   What is the half life?   (1mk)

_____

    ii)   Xg of a radioactive element was reduced to 12.5g in 15.6years. If the half life of the element is 5.2years. Calculate the value of X.   (2mks)

_____

_____

17.   a)   The diagram below shows a structure of water molecules.
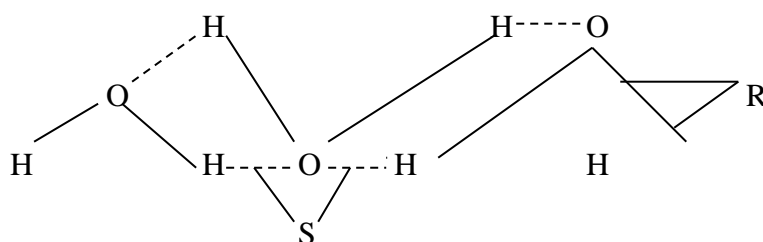
Name the bonds labeled

R -   (½mk)

_____

S -   (½mk)

_____

b)   Using dot (.) and cross (x) diagram sho bonding in;
      i) Potassium chloride (K = 19 Cl = 17)

      ii) Carbon tetrachloride

           C = 6   Cl = 17

18.   i)   In an experiment to determine solubility of solid P in water at 25^0C, the following results
            were obtained.
            Mass of empty evaporating dish – 24.2g
            Mass of evaporating dish + saturated solution = 40.4g
            Mass of evaporating dish + dry solid P = 28.4g
            Using the information above calculate the solubility of solid P at 25^0C in g/100g of water.
   (2mks)

      _____
      _____
      _____

      _____

      ii)   State one precaution observed when carrying out the experiment in (i) above 1   (1mk)

      _____

19. i) Name two conditions that accelerate rusting. (1mk)

_____

ii) State two ways rusting can be prevented. (2mks)

_____

_____

20. The molecular formular of a hydrocarbon C_7H_{16}. The hydrocarbon can be converted into two other hydrocarbons as shown below by the equation below.

$$C_7H_{16} \quad \xrightarrow{\text{Catalyst F}} \quad CH_4 + \text{Substance G}$$
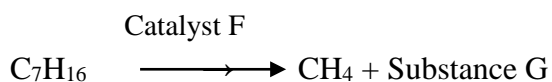
Name i) the process shown by the equation above (1mk)

_____

ii) Catalyst F (1mk)

_____

iii) State one chemical test for substance G (1mk)

_____

21. A solution of bromine in water is a chemical reaction in equilibrium. The reaction involved is represented by the equation below;

$$Br_{2(aq)} + H_2O_{(l)} \quad \longrightarrow \quad 2H^+_{(aq)} + Br^-_{(aq)} + OBr^-_{(aq)}$$

  Yellow   Colourless

State and explain the observation made when concentrated sulphuric (IV) acid is added to the mixture at equilibrium. (2mks)

_____

_____

_____

22. The table below shows solutions and their PH values.

Solution	PH value
L	2.0
M	7.0
N	14.0

i)   Select two solutions that will react with calcium metal. Give a reason.   (2mks)

_____

_____

ii)   Which solution is that of sodium chloride solution?   (1mk)

_____

23. During the extraction of aluminium, cryolite is added to molten aluminium oxide.
i)   State the function of cryolite during the process   (1mk)

_____

ii)   Give two reasons why aluminium is used in making overhead cables.   (2mks)

_____

_____

24.   Study the standard reduction potentials below and answer the questions that follow;
        The letters are not actual symbols of the elements

        Half cell   E$^\ominus$volts
        $P^{2+}_{(aq)} + 2e \rightarrow P_{(s)}$ - 0.76

        $R^{2+}_{(aq)} + 2e \rightarrow R_{(s)}$ - 2.37

        $S^{+}_{(aq)} + 1e \rightarrow S_{(s)}$ + 0.80

        $T^{2+}_{(aq)} + 2e \rightarrow T_{(s)}$ - 0.14

        i) Select the element which is the strongest reducing agent. Give a reason.   (1mk)

_____

        ii) Select two half cells when combined would produce the largest e.m.f   (1mk)

_____

_____

iii)   Calculate the e.m.f of the electrochemical cell formed when the two half cells in (ii) above
        are combined.   (1mk)

_____

_____

25. State two uses of nitrogen gas.   (2mks)

_____

_____

26. When iron fillings are added to aqueous copper (II) sulphate solution a reaction takes place. State three observations made during the reaction. (2mks)

_____

_____

27. A colourless solution was suspected to be water. Give one chemical and one physical best that can be used to show that the colourless solution is water. (2mks)

_____

_____

i) Chemical test: - (1mk)

_____

ii) Physical test: - (1mk)

_____

28. Study the table below and answer the question that follow. The letters do not represent the actual symbols of the element.

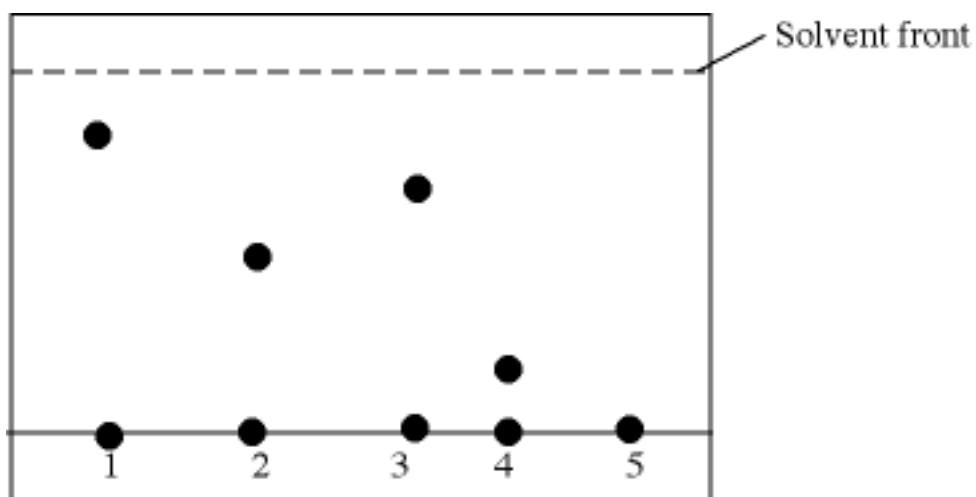| Formula of ion	Electron configuration
W^{2+}	2
V^{2-}	2.8
X^{3+}	2.8
U^{2+}	2.8
Y^-	2.8.8

a) Select elements found in;

i) the same group (1mk)

_____

ii) period three (1mk)

_____

b) What is the family name given the group members to which element Y belongs (1mk)

_____

29. The diagram below represents a paper chromatogram of pure inks marked 1, 2, 3 and 4. 5 is a mixture that contains inks 1 and 4 only.

a) Give a reason why ink 1 moves faster to the solvent front than ink 2. (1mk)

_____

b) Name two factors that determine chromatography. (1mk)

_____

c) Show on the chromatogram diagram the chromatography of K. (1mk)

_____