FORM FOUR CLUSTER KCSE MODEL4

CHEMISTRY PAPER 2 QUESTIONS

1.a) Study the table below and complete it. P3+ and Q2- are not the actual symbols of the ions.

Ion	Number of protons	Numbery of neutrons	Mass number	Electron arrangement
P^{3+}		14		2.8
Q^{2-}	16		32	

a)   State the period to which element P belong. Give a reason.

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b)   Study the table and the information given and answer the questions that follow

Element	Ionic Radius (nm)	Atomic Radius (nm)
X	0.102	0.136
Y	0.134	0.099
Z	0.202	0.181
W	0.170	0.175
Q	0.076	0.065

i)   Which is the most reactive non – metal? Explain.

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ii)   Which elements are metals? Give a reason.

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iii)   Write an equation for the reaction between element Q which is in group (IV) with sodium metal.

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iv)What type of bond and structure is formed in b (iii) above?

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v)Element Z has atomic number 6. State the nature of its stable oxide when dissolved in water.

2.Use the standard electrode potentials for the elements A, B, C and D. Given below to answer the questions that follow. The letters do not represent the actual symbols.

$$E^\theta \text{ (Volts)}$$

$$A^{2+}{}_{(aq)} + 2\bar{e} \rightarrow A_{(S)} \qquad -0.76$$

$$B^{2+}{}_{(aq)} + 2\bar{e} \rightarrow B_{(S)} \qquad -0.44$$

$$C_{2(g)} + 2\bar{e} \rightarrow C^{2-}{}_{(aq)} \qquad +0.54$$

$$D^{4+}{}_{(aq)} + \bar{e} \rightarrow O^{3+}{}_{(aq)} \qquad +1.61$$

a)   i) Explain why the reaction between element B and an ion of A is not possible.

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ii) Which element is the:

I.   Strongest oxidizing agent.

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II.   Strongest reducing agent?

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b)   Calculate the EØ value of the elements which if used in a cell would produce the largest electromotive force. (E.M.F)

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c)the number of Faradays required to completely reduce 0.1 mole of Fe3+ to Fe.

d)One application of electrolysis is electroplating in chromium plating, the steel article is usually plated first with nickel or copper then chromium in sulphuric (VI) and water.

i)Give a reason why steel is chromium plated.

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ii)   Why it is necessary for the steel to be plated first with nickel or copper before chromium is applied?

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iii) If 4.5 amperes are passed through chromium salt for 20 minutes. Calculate the mass in grams of chromium deposited on the steel article. (Cr =52.0, 1 Faraday =96500coulombs).

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3.The grid below represents part of the periodic table. Study it and answer the questions that follow

a) **i) Write an equation for the reaction between element G and A.**

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ii) **How does the atomic size of C and E compare. Explain**

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iii) **State the observation when the chloride of E is exposed to air.**

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iv) **Explain why when an ion of X is formed, energy is given out.**

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b) **On the grid indicate the position of the element Z which is in period 3 and forms an ion of Z3-**

c) **i) Explain why hydrogen occupies the two positions as shown in the grid. (1mark)** ....

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. ii) Write an equation for the reaction between Q and hydrogen.

iii)   State the family of elements to which G belong.

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iv)   Explain why element R is a better combustor of electricity than G.

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4.   Study the information in the flow chart below and answer questions that follow
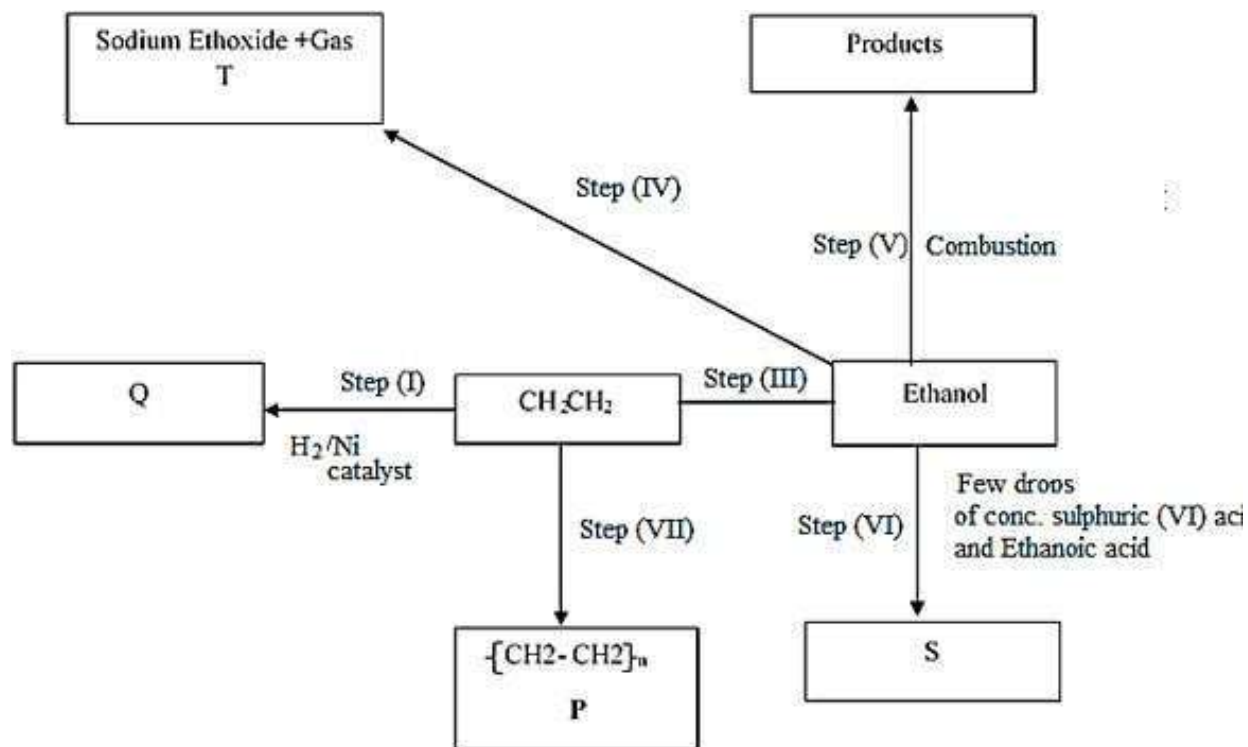
a)   Identify the compounds.

i)   Q

ii) S

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b) State:-

i) Type of reaction in step I

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ii) Conditions in step (VII)

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c) Write an equation for the reaction in step (v).

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d) Explain the effects of prolonged use of substance P on the environment.

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e) Draw and name the structure the structure of the compound formed when Q reacts with chlorine gas.

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f) Give the: i) Name of the substance used in step (IV).

ii) Name of the gas T.

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5.　　**a) Below is an energy level diagram for the formation of water.**
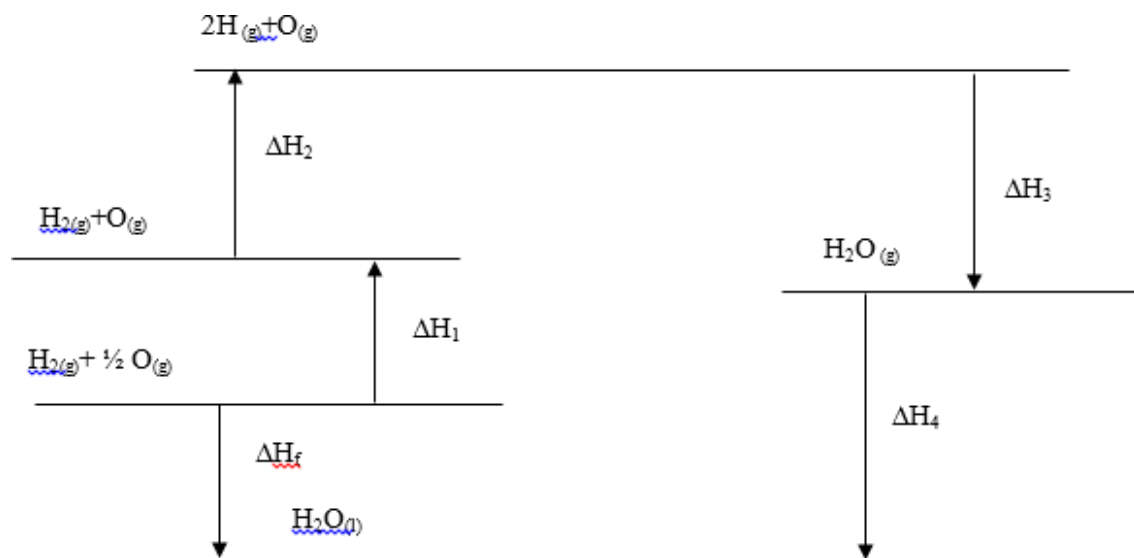
i)　　**Which ΔH values will have a positive sign?**

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ii)　　**Which change is represented by ΔH1.**

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iii)　　**Identify the process taking place in Δ where ΔH4 is involved.**

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iv)　　**Determine the heat of formation of water (ΔHf) in terms of ΔH1,ΔH2, ΔH3 and ΔH4.** …………………

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v) **Explain whether the reaction in (IV) is exothermic or endothermic.**

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b)1.0g of zinc powder was added to 50cm3 of a 0.2M copper (II) Sulphate solution and the mixture rose from 200C to 270C.

i) **Besides temperature rise, state two other observations made.**

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ii) **Write an ionic equation for the reaction that occurred.**

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iii) **Calculate the number of moles of copper (II) sulphate used in the reaction above. ....**

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iv) **Calculate the molar heat of displacement of copper. (C= 4.2kJ/kg/k, density of solution = 1g/cm3)**

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6. **a) i) Starting with calcium carbonate and hydrochloric acid draw a labelled diagram of the set – up of apparatus that can be used to prepare a dry sample of carbon (IV) oxide in the laboratory.**

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ii) Write an equation that leads to the formation of carbon (IV) oxide.

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b)   Burning magnesium was lowered into a gas jar of carbon (IV) oxide.

i)   State what was observed.

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ii)   Explain the observation in b (i).

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c)   Water was added to the product in (b) and the resultant mixture tested with red litmus paper. State what was observed.
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d)   When a solution of sodium hydroxide is exposed to air, a white solid is formed on the surface.

i)   Name the white solid.

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ii) **Write equations to show how the white solid is formed.**

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7. **a) Sodium metal is extracted by the electrolysis of molten sodium chloride to which calcium chloride has been added.**

i) **Give a reason for the addition of calcium chloride.**

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ii) **Name the material that can be used as the anode. Give a reason for your choice. ....**

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iii) **Write equations for the reactions at the electrodes**

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iv) **Explain how calcium is removed during the extraction of sodium.**

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v) **Name another element that can be extracted by a similar method**...

b) **Give a reason why the sodium extraction plant should be situated near the electricity generating plant**...

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v) **Name another element that can be extracted by a similar method.**

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....

b) **Give a reason why the sodium extraction plant should be situated near the electricity generating plant.**

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c) **State two uses of sodium metal.**

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