Name .... **Index No.** ....

School .... Candidates signature ....

233/2   Date ....
CHEMISTRY
Paper 2
(Theory)
July 2017
Time : 2 Hours

FORM 4 END OF TERM 2 EXAM

CHEMISTRY
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July 2017
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<u>INSTRUCTIONS TO CANDIDATES</u>

a)   Write your name and index number in the spaces provided.
b)   Sign and write the date of examination in the spaces provided.
c)   Answer **all** questions in the spaces provided in the question paper.
d)   Mathematical tables and silent calculators may be used.
e)   All working must be clearly shown where necessary.
f)   Candidates should check the question paper to ascertain that all pages are printed.
g)   Use English when answering the questions.

<u>For Examiner's Use Only</u>

1. **a)** State two factors to consider when choosing fuel for cooking.   (2 marks)

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   b) On burning a fuel, the molar heat of combustion obtained is found to be lower than the theoretical value. State two sources of the deviation.   (1 mark)

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   c) Below are results obtained in an experiment to determine the enthalpy of solution of sodium hydroxide.
   Mass of plastic beaker = 10g
   Mass of plastic beaker + distilled water = 110.15g
   Mass of plastic beaker + distilled water + NaOH = 116.35g
   The table below shows the temperature at fixed times after mixing sodium hydroxide and water.

Time secs	0	30	60	90	120	150	180	210
Temp. °C	15	21	29	28	27	26	25	25

   i) Plot a graph of temperature against time.   (3 marks)
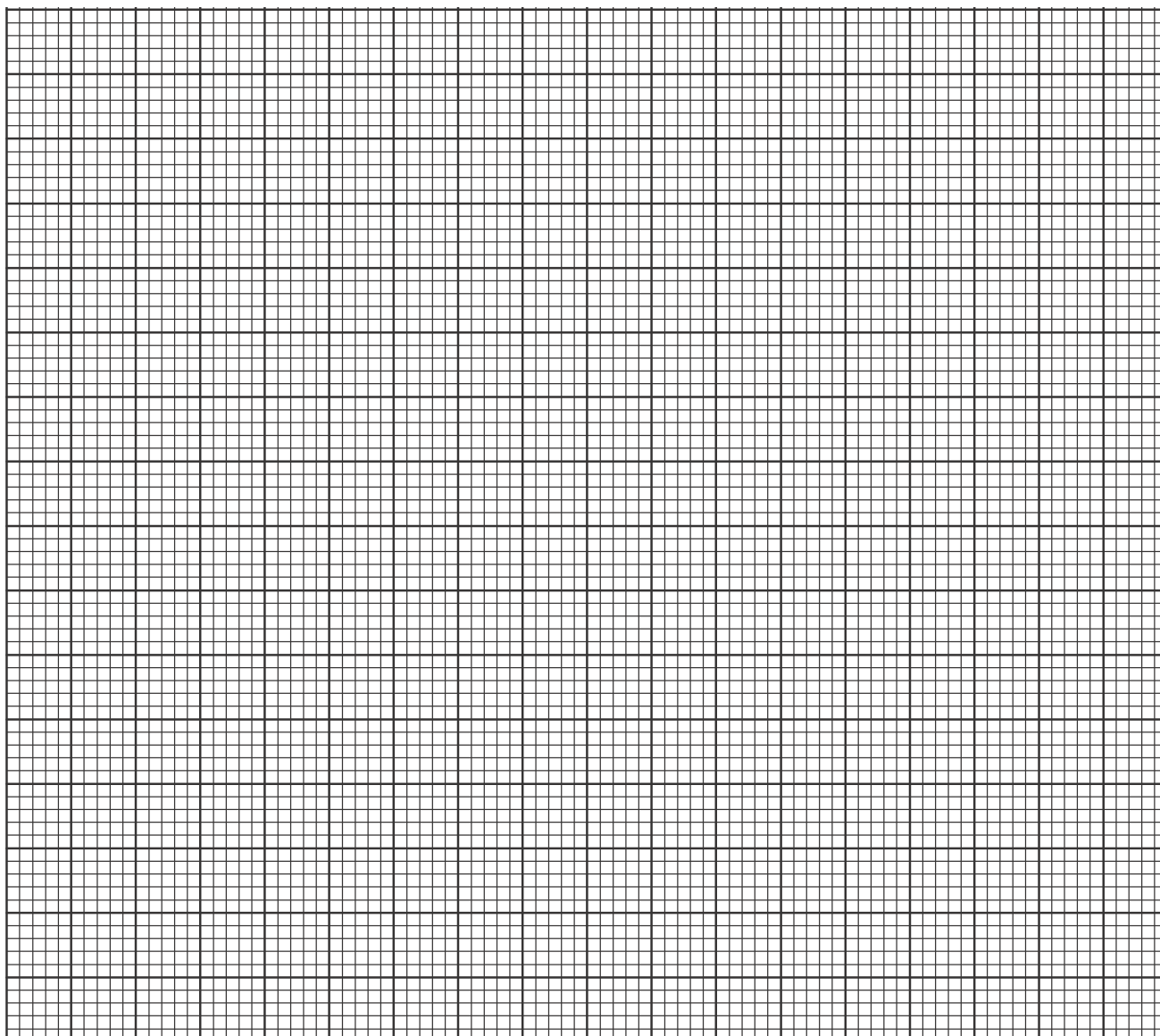
ii) From your graph, determine the maximum temperature attained.   (1 mark)

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iii) Determine the temperature change of the reaction.   (1 mark)

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iv) Calculate the number of moles of sodium hydroxide used in the experiment.   (1 mark)
     (Na = 23, H = 1, O = 16)

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v) Use your results to determine the molar heat of solution of sodium hydroxide.
    (Density of the solution = $1g/cm^3$, specific heat capacity of the solution is $4.18KJk^{-1}mol^{-1}$)
                                                                                       (2 marks)

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vi) What is molar heat of solution ?   (1 mark)

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2. **a)** Study the table below and answer the questions that follows. The letters are not the actual symbols
    of elements.

Element	No. of protons	Melting point °C	Boiling point °C
P	11	98	890
Q	12	650	1110
R	13	690	2470
S	14	1410	2360
T	15	442/590	280
U	16	113/119	445
V	17	-101	-35
W	18	-189	-186

i) State and explain the trend in melting point in P, Q and R.   (2 marks)

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ii) Explain why the melting point of elements S is the highest. (1 mark)

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iii) Why do elements E and F have two melting points ? (1 mark)

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iv) Write down the chemical formula between R and the sulphate ion. (1 mark)

....

v) Name the chemical family to which element W belong to. (1 mark)

....

vi) What is the nature of oxides represented by elements R and U respectively. (1 mark)

....

....

b) The grid below is part of the periodic table. Use it to answer the questions that follows. (The letters are not the actual symbols)

						A	B
						F	
C	D				G		E
	H						

i) Write down the formula of the compound formed between C and A. (1 mark)

....

ii) Show the position of element Q in the periodic table having atomic number 15. (1 mark)

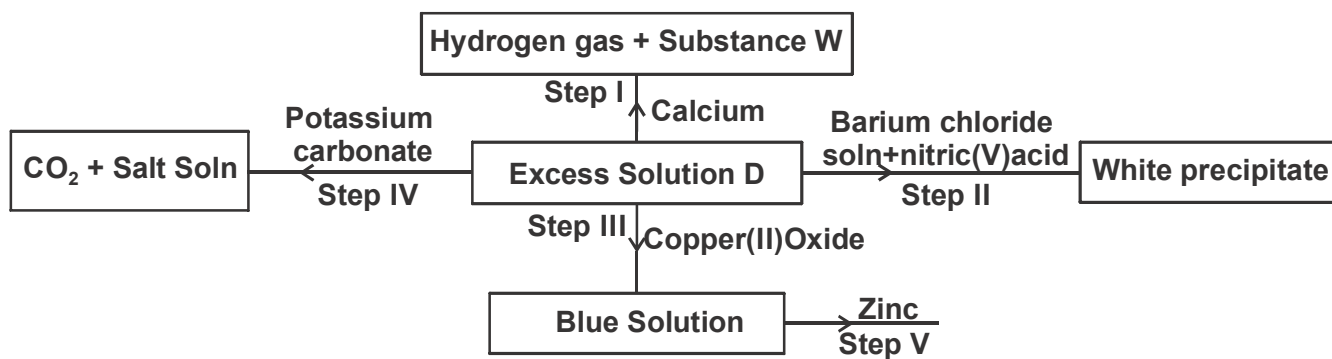iii) Explain how atomic radius of C and F compare. (1 mark)

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iv) Using dots (•) and crosses (x) to represent electrons, show bonding in the chloride of H. (2 marks)

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3. a) The scheme below shows some of the reactions of solution D. Study it and answer the questions that follows.

i) Give a possible cation present in solution D. (1 mark)

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ii) Write an ionic equation for the reaction in step II. (1 mark)

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iii)What observations would be made in step V ? (1 mark)

....

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iv)Why is the total volume of hydrogen gas produced in step I found to be very low although calcium and solution D are in excess ? (2 marks)

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v) State one use of substance W. (1 mark)

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b) Starting with sodium chloride, describe how a pure sample of lead (II) chloride can be prepared in the laboratory. (2 marks)
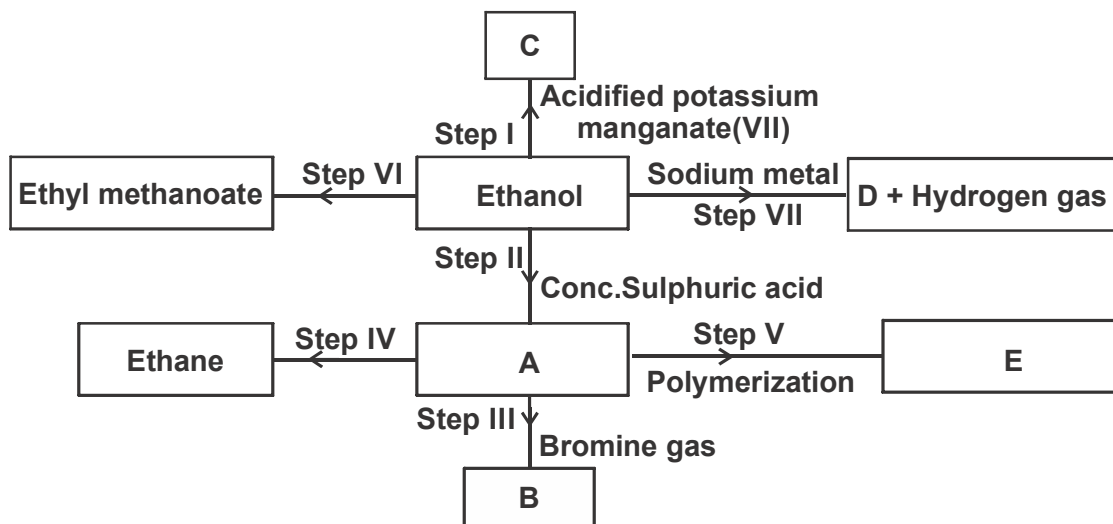
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c) i) State a property of anhydrous calcium chloride which makes it suitable for use as a drying agent for chlorine gas. (1 mark)

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ii) Name another substance that can be used to dry chlorine gas. (1 mark)

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4. **a)** Study the flow chart below and answer the questions that follows.

i) What observation will be made in step I. (1 mark)

....

ii) Name the following : (2marks)

I. Substance E ....

II. Substance D ....

iii) Name the type of reaction that occurs in : (2 marks)

Step II ....

Step IV ....

iv) Give the reagent and conditions necessary for step (VI) to obtain the given product. (1 mark)

Reagent ....

Condition

....

v) Describe a chemical test that can be carried out to show the identity of compound C. (2 marks)

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vi) Give the formula for substance B. (1 mark)

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b) When one mole of ethanol is completely burnt in air, 1370KJ of heat is released. Given that one litre of ethanol is 780g, calculate the amount of heat energy released when one litre of ethanol is completely burnt. (C = 12.0, H = 1.0, O = 16.0) (2 marks)

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5. Study the information given below on standard electrode potentials for some half reactions and use it to answer the questions that follows.

	E^θ / volts
$Ce^{4+}_{(aq)} + e^- \rightarrow Ce^{3+}_{(aq)}$	+1.61
$Fe^{3+}_{(aq)} + e^- \rightarrow Fe^{2+}_{(aq)}$	+0.77
$I_{2(aq)} + 2e^- \rightarrow 2I^-_{(aq)}$	+0.54
$Fe^{2+}_{(aq)} + 2e^- \rightarrow Fe_{(s)}$	-0.44
$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)}$	-0.76
$J^{3+}_{(aq)} + 3e^- \rightarrow J_{(s)}$	X

a) Identify the strongest reducing agent. (1 mark)

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b) Which substance in the table is suitable to oxidise iodide ion to iodine ? (1 mark)

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c) Study the cell representation below and answer the questions that follow.

   KNO₃

   $Zn_{s)} / Zn^{2+} /\!/ Fe^{2+}_{(aq)} / Fe_{(s)}$
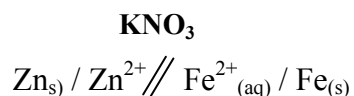
i) Identify the anode and the cathode. (1 mark)

   Anode ....

   Cathode ....

ii) If the two half cells are connected externally, write an equation for the reaction taking place in zinc half cell. (1 mark)

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iii) Calculate the e.m.f of the cell. (1 mark)

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iv) State the purpose of the salt bridge in the cell. (1 mark)

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v) Explain what would happen if $KCl_{(aq)}$ is used in the salt bridge instead of KNO_3 in a case where $Pb_{(s)}/Pb^{2+}_{(aq)}$ is one of the half cells. (2 marks)

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vi) Draw on electrochemical cell to represent the cell in c(ii) above. (3 marks)

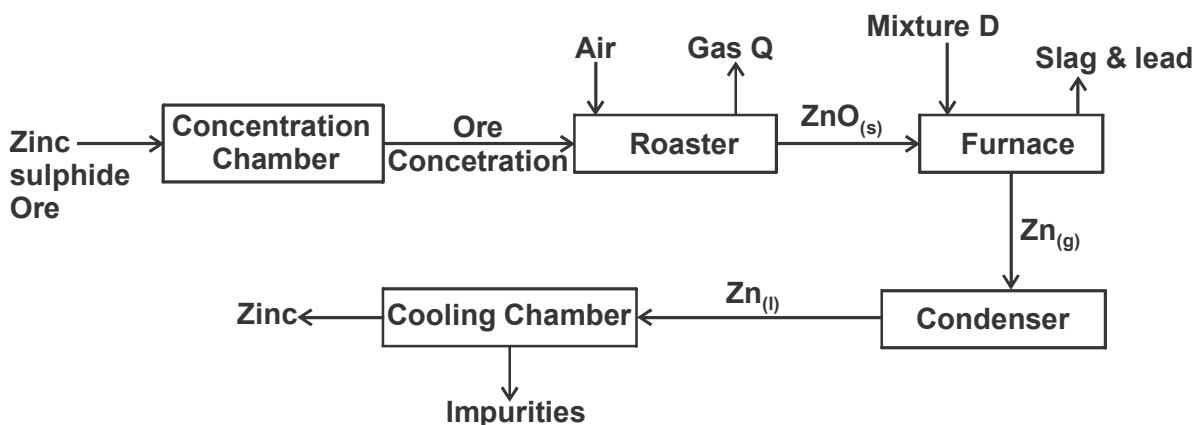..

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vii) If the e.m.f of the cell $J_{(s)}/J^{3+}_{(aq)}/I_{2(s)}/2I^-_{(aq)}$ is +1.32V, calculate the value of $J^{3+}_{(aq)}/J_{(s)}$. (1 mark)

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6. The flow chart below illustrate the extraction of zinc. Study it and answer the questions that follow.

a) i) Name the ore from which zinc is extracted. (1 mark)

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ii) Give the formula of the main component in the ore named above. (1 mark)

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iii)Name gas Q .... (1 mark)

b) What is the method commonly used for the concentration of the ore you named in (a) above.

(1 mark)

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c) Give the equation for the main reaction that takes place in the furnace. (1 mark)

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d) Beside $ZnO_{(s)}$ name the other two substances that are fed into the furnace. (1 mark)

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e) Name the major impurity that is removed in the cooling chamber. (1 mark)

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f) Suggest with reasons two other factories that could be set near the zinc extraction plant. (2 marks)

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g) Give two detrimental effects on the environment that may result from the extraction of zinc.

(2 marks)

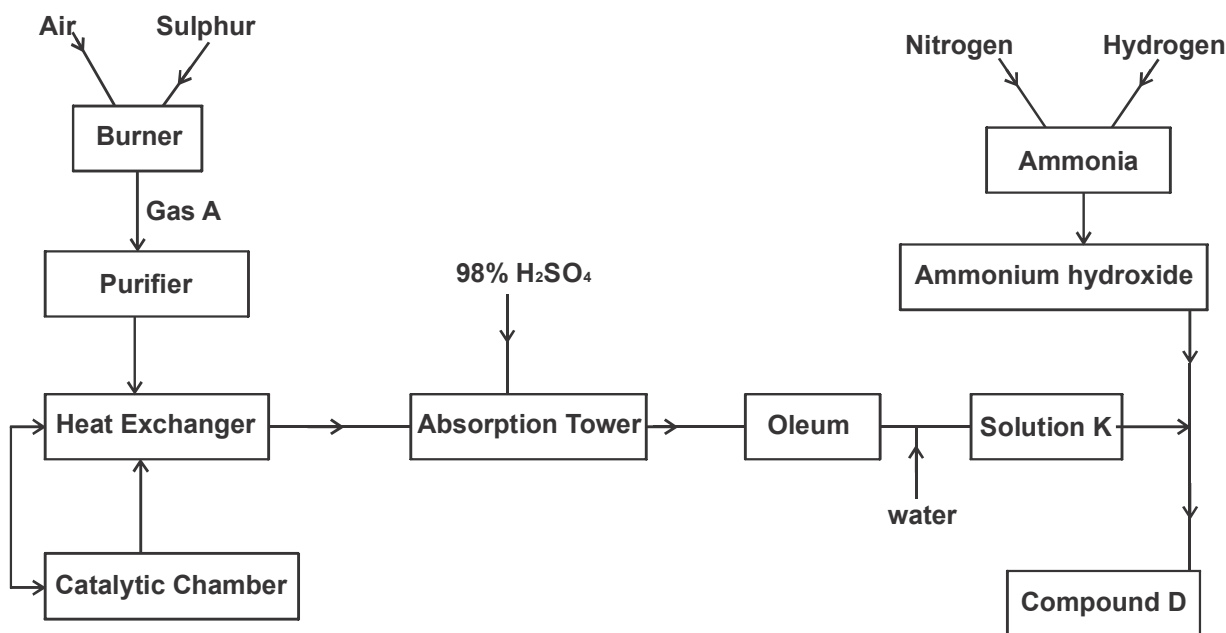...

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h) Name two uses of zinc. (1 mark)

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7. Below is a chart showing the commercial production of compound D. Study it and answer the questions that follow.

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

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b) Why is it important to purify the products from the burner before being used in the stages that follow. ? (1 mark)

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c) Give one function of heat exchange. (1 mark)

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d) Give two reasons why Vanadium (V) oxide is preferred to platinised asbestos in the process. (2 marks)

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e) i) Name gas A ....

ii) Why is water not used in place of concentrated sulphuric (VI) acid in the absorption tower ? (1 mark)

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f) Name substances K and D. (2 marks)

K .... D ....

g) Explain the environmental effects of gas A if released to the atmosphere.

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