

NAME ..... DATE .....

INDEX NO. .... SIGNATURE .....

233/2  
CHEMISTRY  
PAPER 2  
(THEORY)  
KCSE MOCKS 2017

TIME: 2 HOURS.

**INSTRUCTIONS TO CANDIDATES.**

- Write your name and index number in the spaces provided above.
- Sign and write the date of exam in the spaces provided above.
- Answer **ALL** the questions in the spaces provided.
- Mathematical tables and silent electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.
- This paper consists of 12 printed pages. Candidates should check to ensure that all pages are printed as indicated and no questions are missing

**FOR EXAMINER'S USE ONLY.**

Questions	Maximum score	Candidates score
1	9	
2	10	
3	9	
4	14	
5	8	
6	9	
7	9	
8	12	
<b>Total score</b>	<b>80</b>	

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

The letters do not represent the actual symbols of the elements.

				B		A		
	Y			C	D		E	
F	G							
							H	

a) State the elements (letters) that can form ions with a charge of -1. Give a reason for your answer. (1mark)

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b) What type of structure would the oxide of F have? Give a reason for your answer. (1mark)

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c) How does the reactivity of H compare with that of E. Explain. (1mark)

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d) 1.3g of Y reacts completely with 1.21dm<sup>3</sup> of chlorine gas when heated at s.t.p (molar gas volume at s.t.p = 22.4dm<sup>3</sup>)

(i) Write a balanced chemical equation for the reaction between Y and chlorine. (1mark)

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(ii) Determine the relative atomic mass of Y. (2marks)

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e) The oxide of element B has a low melting point than the oxide of element G. Explain. (2marks)

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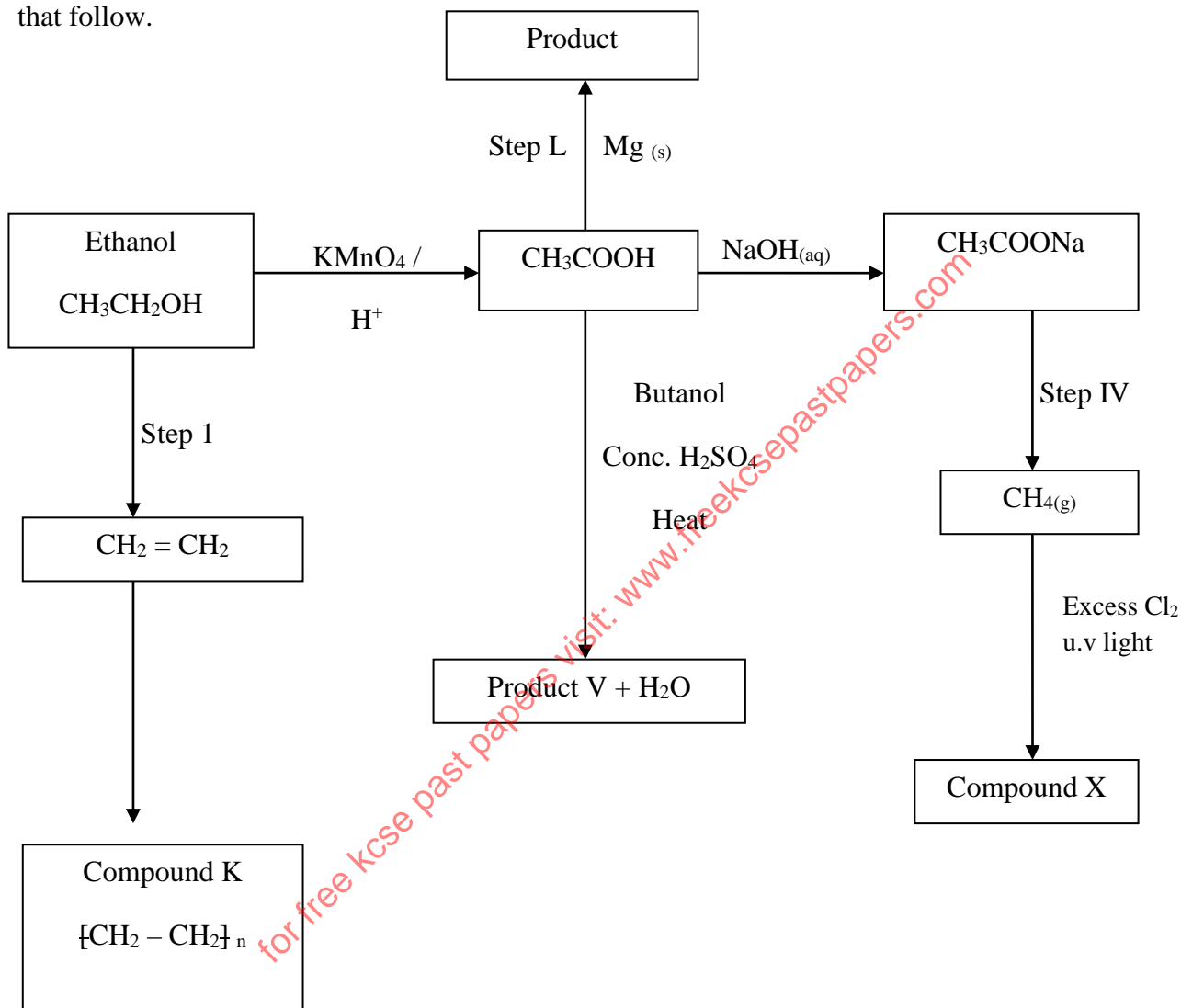
f) Element Y has a larger atomic radius than element C. explain. (1mark)

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2. The scheme below shows a series of reactions starting with ethanol. Study it and answer the questions that follow.



a) Name the type of reaction in step I (1mark)

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b) Give the reagent and condition necessary for step I to take place (2marks)

Reagent

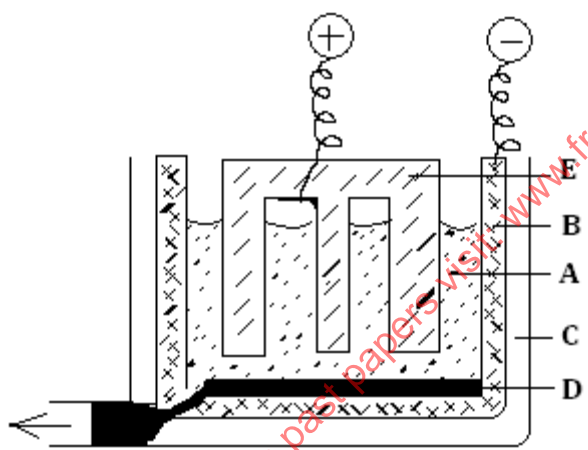
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Condition

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- c) Write the equation for the reaction that takes place in step L (1mark)
- .....
- d) Name the product V and give the equation responsible for its formation. (2marks)
- .....
- e) Give the IUPAC name and structural formula of compound X (2marks)
- .....
- .....
- f) Name compound K and state the type of reaction involved in its formation (2marks)
- .....
- .....

3. Aluminium is extracted from its ore by electrolytic method. The current required in the electrolytic plant is 40,000 amperes. Use the diagram to answer the questions that follow.



- i) Name the chief ore used during extraction of Aluminium (1mark)
- .....
- ii) Name the material that electrodes B and E are made of (1mark)
- .....
- iii) Write the equation for the reaction that produces aluminium at electrode B (1mark)
- .....
- iv) Substance A contains a mixture of the processed cryolite. Explain why cryolite is added to it. (1mark)
- .....
- .....
- .....

v) Explain why aluminium is not extracted by reduction using carbon? (2marks)

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vi) Electrode E has to be replaced periodically. Explain. (1mark)

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vii) State why aluminium alloys are preferred to pure aluminium metal in the construction of aeroplane bodies. (1mark)

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viii) Though copper is a better conductor of electricity, aluminium is preferred in making overhead cables. Give a reason. (1mark)

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4. The standard electrode potentials for the element chlorine and magnesium are.



a)

i) Which one of the two elements will act as an oxidizing agent? Explain (1½ mark)

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ii) Calculate the EMF of a cell where the overall reaction is (1mark)



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b) The table gives the standard electrode potentials for divalent metals represented by the letters P, Q, R and S. (Not their true element symbols). Use them to answer the questions that follow.

Metals	$E^\theta$ (volts)
P	+1.50
Q	- 0.44
R	+0.34
S	- 0.76

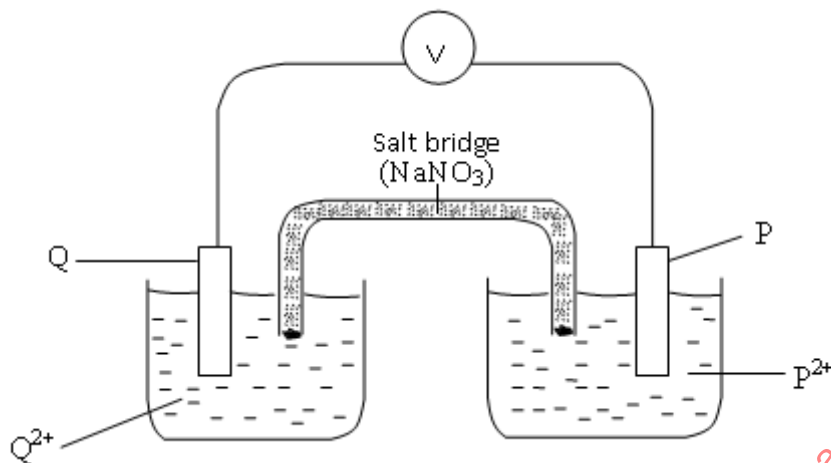
- (i) Which metal cannot be displaced from a solution of its ions by any of the other metals in the table. Explain. (1½ marks)

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- (ii) Metal P and Q were connected to a cell as shown in the diagram below.



- a) On the diagram show the direction of electron flow. (1mark)
- b) Write ionic half equations for the reactions taking place at the electrodes; P and Q. (2marks)

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- c) State two functions of the salt bridge. (1mark)

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- d) Write a conventional representation of the cell. (1mark)

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- (iii) A metallic couple of metal S and Z produced a voltage of +1.71V. (Assume that S has more negative standard electrode potential)

- a) Calculate the standard electrode potential (S.E.P) for metal Z (1mark)

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- b) Arrange the metals P,Q,R and Z in their descending order of reactivity. (1mark)

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c. A nitrate solution of a certain metal X was electrolyzed. 1.18g of metal X was deposited by a current of 4 amperes, flowing for 16 minutes. Determine the formula of the metal nitrate.

(IF = 96,00C, RAM OF X = 59)

(3marks)

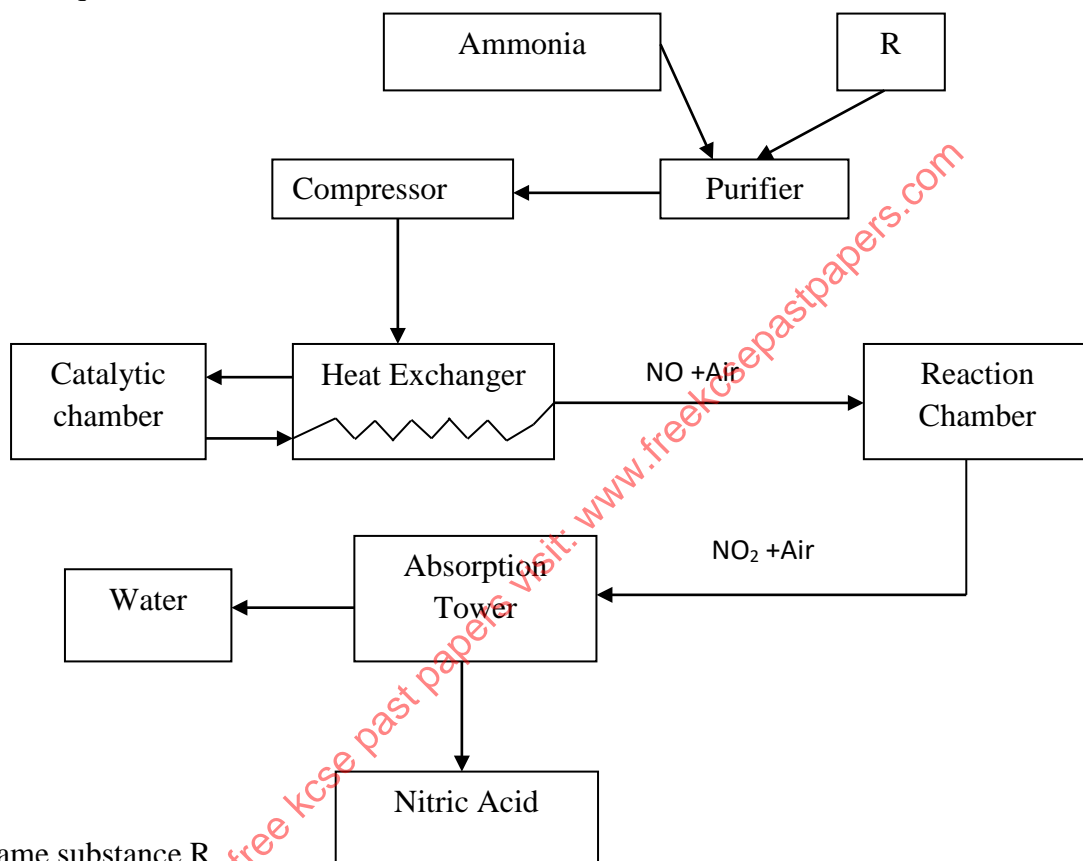
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5. The flow chart below shows the large – scale manufacture of Nitric acid (Ostwald process) study it and answer the questions that follow.



a) Name substance R (1mark)

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b) Name one source of Ammonia used in the process. (1mark)

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c) Write a balanced equation for the reaction which takes place in the reaction chamber (1 mark)

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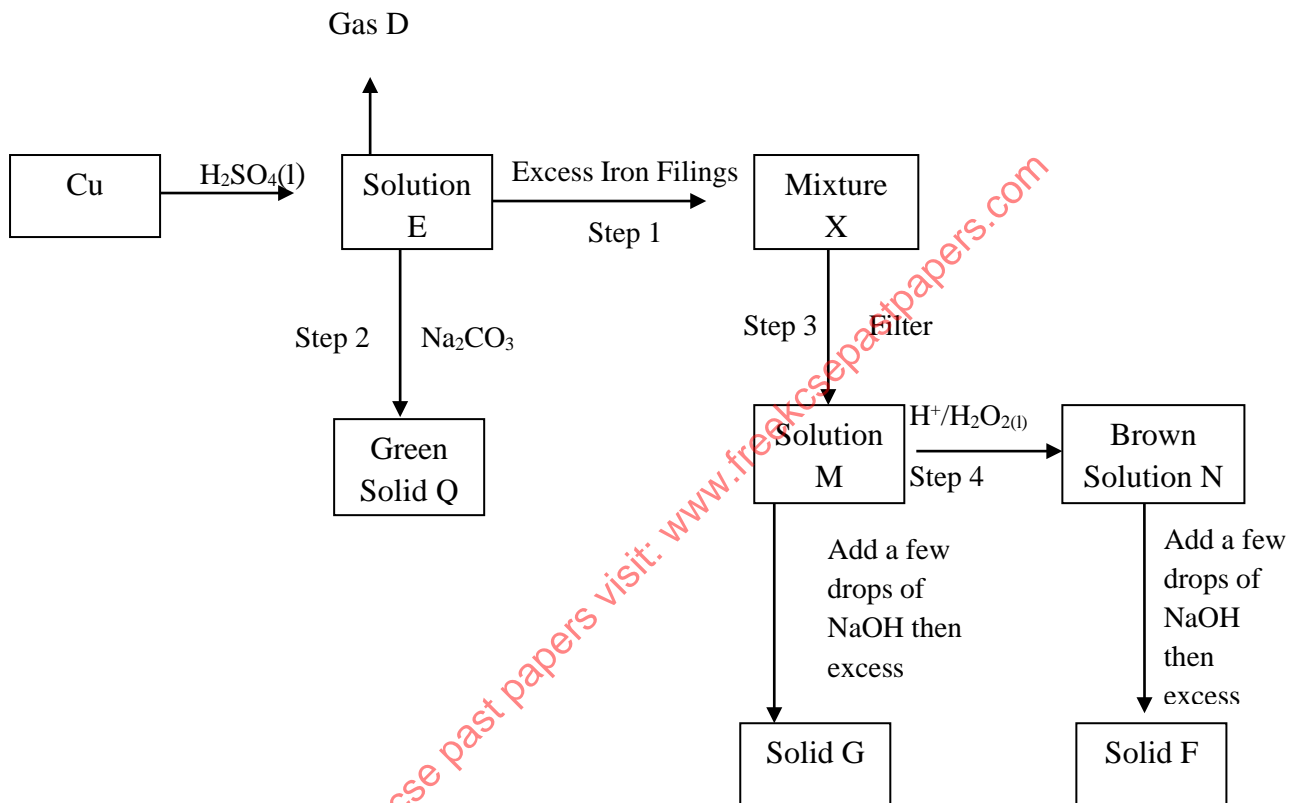
d) Write a balanced equation for the reaction taking place in the absorption tower. (1mark)

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e) Name the catalyst used in this process. (1mark)

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- f) What is observed when
- i) A transparent bottle containing concentrated nitric (v) acid is exposed to sunlight. (1mark)
- .....
- ii) Concentrated nitric acid is heated with sulphur. (1mark)
- .....
- iii) Write a balanced equation for the reaction in f (ii) above. (1mark)
- .....
6. Study the flow chart below and answer the questions that follow.



- (i) Name the following substances. (2marks)
- solution E
  - .....
  - green solid Q
  - .....
  - solid F
  - .....
  - solution M
  - .....



(ii) State the observation made at step I (1mark)

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(iii) What is the role of  $H^+$  /  $H_2O_2$  in step 4 (1mark)

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(iv) Name the reaction that takes place at step 2 (1mark)

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(v) Draw a well labeled set up to show how mixture X is separated. (2marks)

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(vi) Write chemical equation to represent the formation of solid G. (1mark)

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(vii) Explain what happens if sulphur (iv) oxide gas was bubbled through brown solution N 1mk

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7. To investigate the effect of concentration on reaction rate, a student measured  $50\text{cm}^3$  of 2M sulphuric (VI) acid and transferred it into a 100ml beaker. The student then added 1cm length of magnesium ribbon and noted the time taken for the ribbon to react completely. This experiment was repeated with the same length of magnesium ribbon and  $40\text{cm}^3$  of 2M of sulphuric (VI) acid, diluted to  $50\text{cm}^3$  by adding  $10\text{cm}^3$  of distilled water. The table below shows the volume of distilled water added and the time taken for the reaction to reach completion.

Volume of 2M $H_2SO_4$	Volume of water added ( $\text{cm}^3$ )	Concentration, C after adding water ( $\text{mol dm}^{-3}$ )	Time taken (s)
50	0	2	6.0
40	10	1.6	7.5
30	20	—	10.0
25	25	—	12.0
20	30	—	15.0
10	40	—	24.9

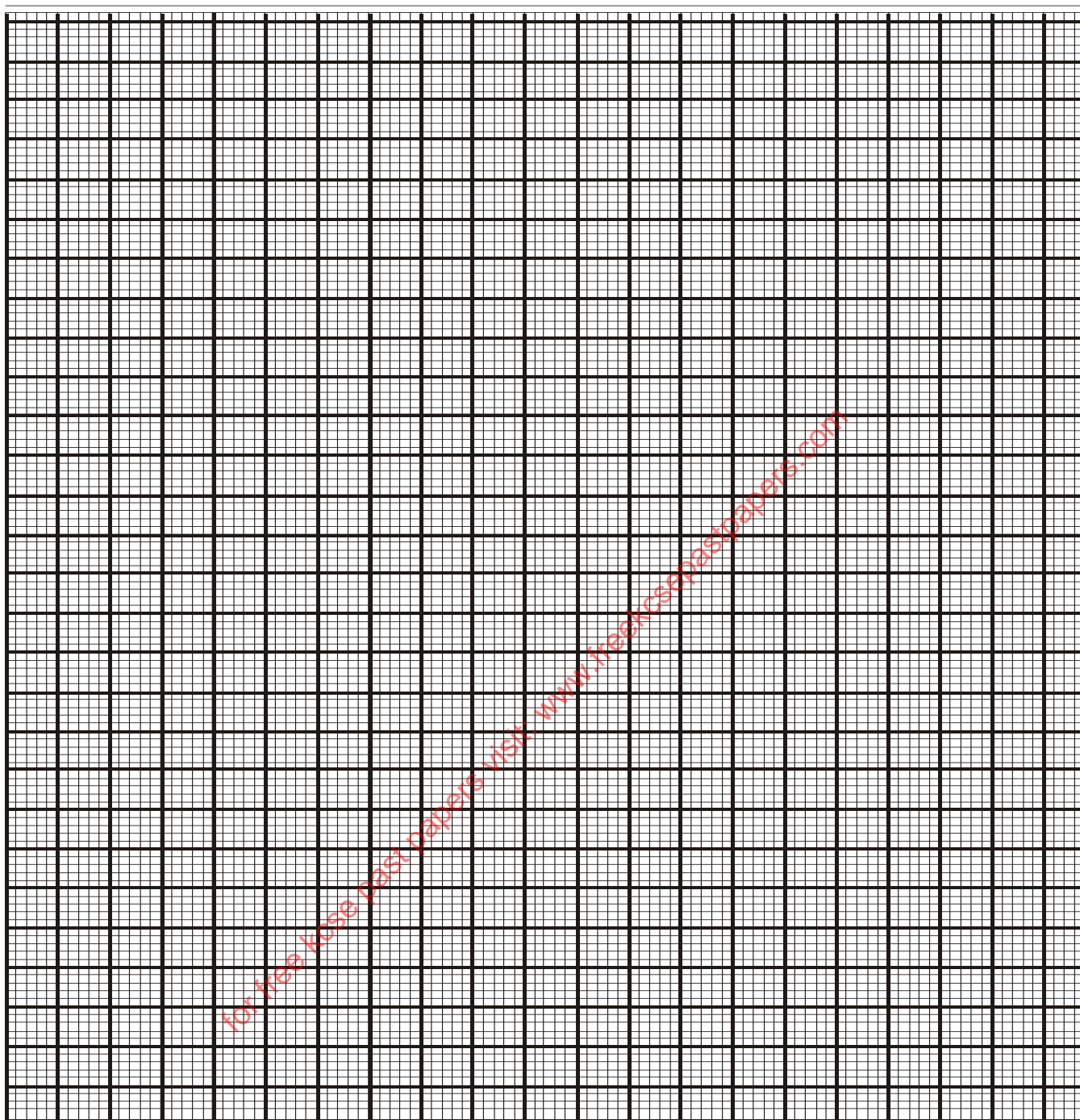
a) Complete the table to show the concentration, C of the solutions used. (2marks)

b) Explain why the total volume was kept constant. (1mark)

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Plot a graph of the reciprocal of time ( $1/t$ ) against concentration.

(3marks)



c) From the graph, determines the time if  $35\text{cm}^3$  of  $2\text{M H}_2\text{SO}_4$ , diluted to  $50\text{cm}^3$  were used. (1mark)

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.....

d)  
i) What does the reciprocal of  $t$  represent? (1mark)

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- (ii) Suggest a reason why the graph does not pass through the origin (0,0) (1mark)

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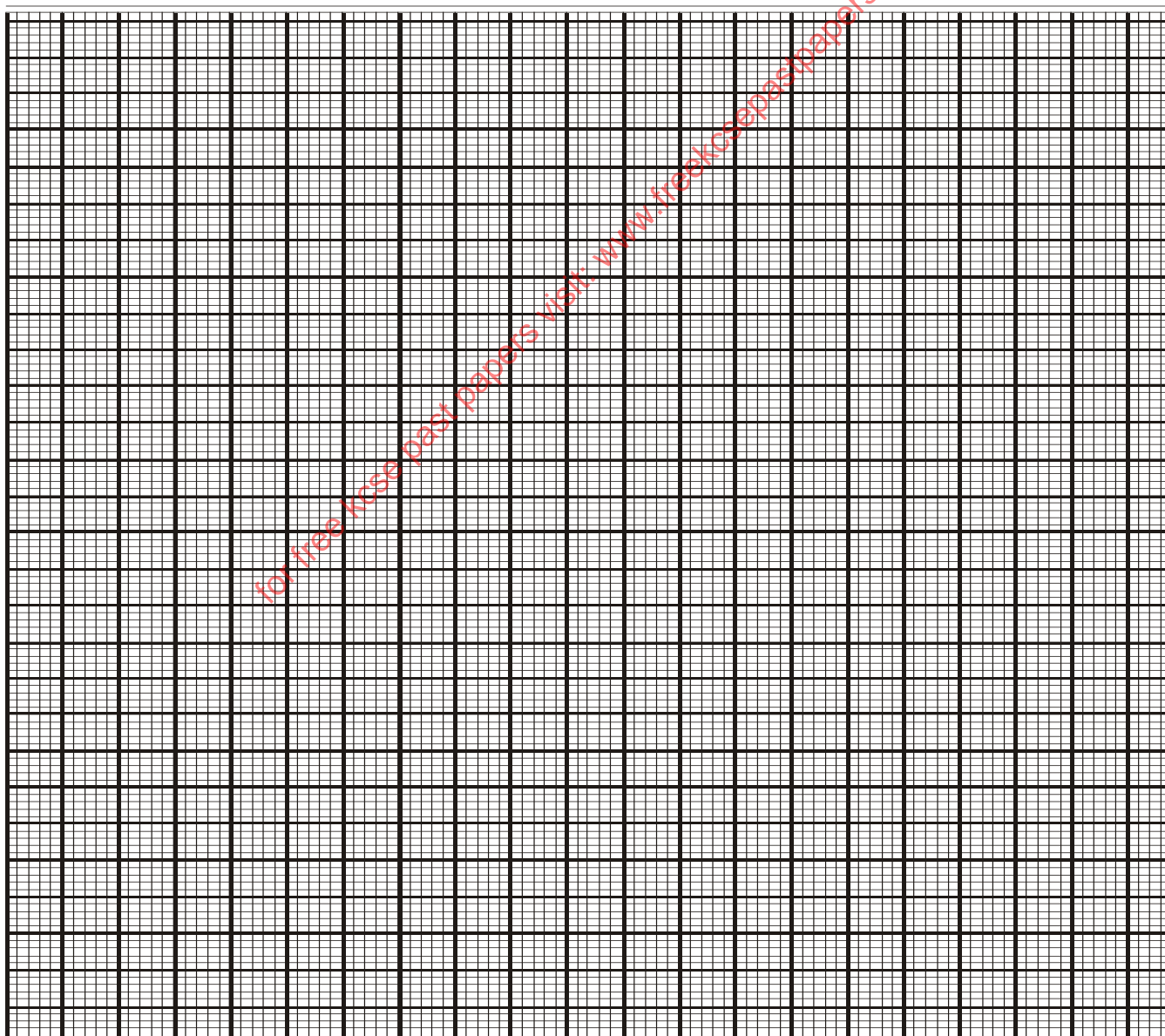
8. The table below shows the solubilities of two salts L and M at different temperatures. Study it and answer the questions that follow.

Temperature		10	20	30	40	50
Solubilities	L	11.0	14.0	20.1	28.0	36.0
	M	15.0	17.0	19.0	21.2	25.0

- (i) Name the method that can be used to separate the two salts. (1mark)

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- (ii) Plot on the same axes a graph of solubilities of L and M against temperature. (3marks)



- (iii) From the graph determine,
- a. The temperatures at which solubilities are equal (1mark)
- .....
- .....
- b. The solubility at the temperature mentioned above. (1mark)
- .....
- .....
- (iv) If the relative formula mass of M is 132, determine the concentration of M in moles per liter in (iii) b above. (3marks)
- .....
- .....
- .....
- (v) A solution contains 38g of L and 22g of M at 50<sup>0</sup>C. Calculate the total mass of crystals obtained in cooling this solution to 30<sup>0</sup>C. (3marks)
- .....
- .....
- .....
- .....

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