Kib

CHEMISTRY DEPARTMENT 2023
S.6 BRAINSTORMING TEST
TOPIC; PHYSICAL EQUILIBRIA
SUB-TOPIC; SOLIDIFICATION OF SOLUTIONS
PART ONE; EUTECTICS TIME; 45mins

NAME KIBUGO DENNIS INDEX number ..... 17th MAY 2023.

Signature ..... expected score(%).....

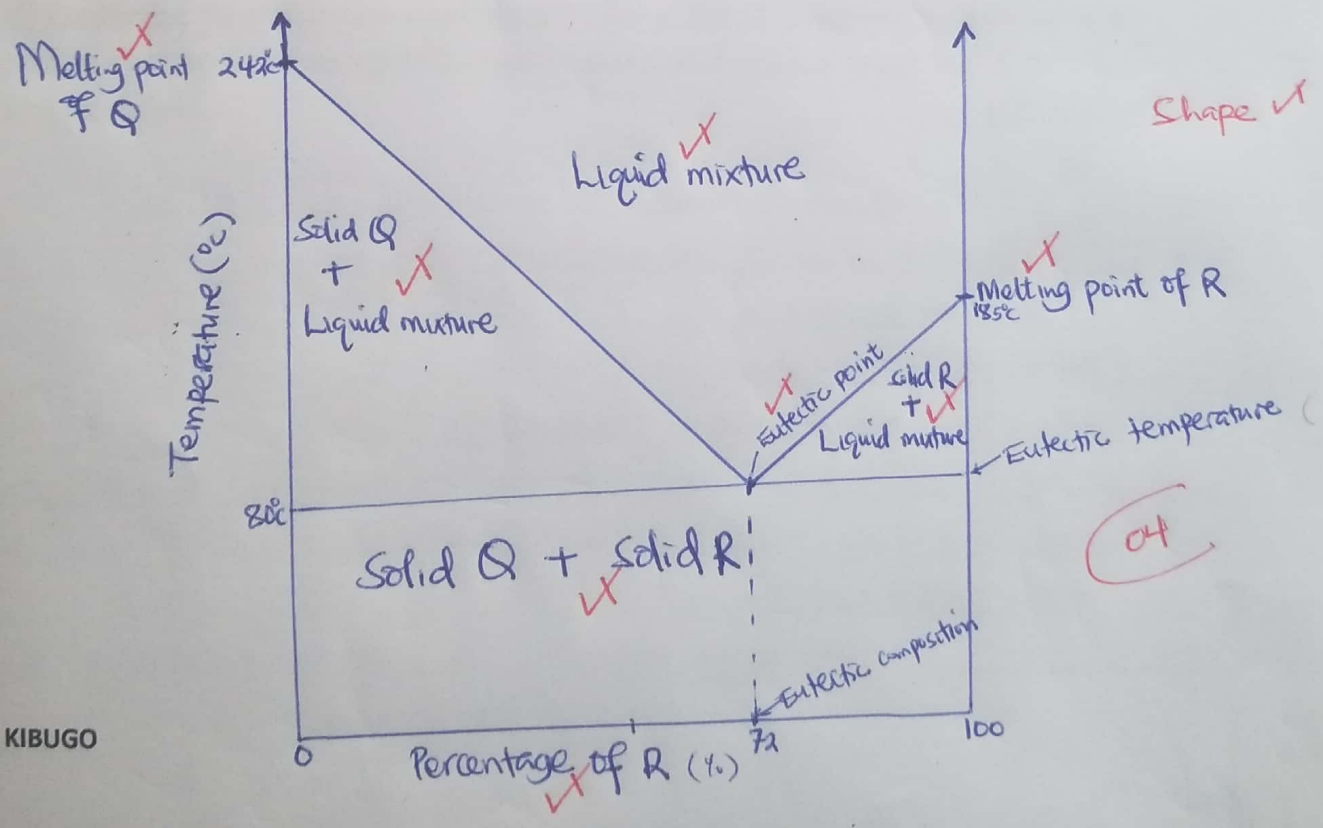
Instructions; Attempt all questions in this paper.

SECTION A

(a) Define the term eutectic mixture. (01 mark)

is a liquid mixture at constant pressure that solidifies at constant temperature to form a heterogenous solid of the same composition as the liquid mixture. ✓ 01

(b) Two metals Q and R form a eutectic mixture with an eutectic point 80°c and 72%R. Draw a well labeled phase diagram for the two metals. (Melting points of Q and R are 242°c and 185°c respectively.



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b) Briefly describe how a phase diagram of a mixture of naphthalene-biphenyl can be determined in the laboratory. (03 marks)

- Mixtures of various compositions of solid napthalene and solid biphenyl are prepared.
- Each mixture is heated separately until it melts.
- Each mixture is allowed to cool while stirring and the constant temperature at which each freezes is recorded.
- The melting points of pure napthalene and pure biphenyl is determined in same way.
- A graph of melting points against composition is plotted and a phase diagram drawn.

03

b) The table below shows the melting points of various mixtures of naphthalene - biphenyl system.

Percentage of naphthalene (%)	12.5	27.5	62.5	80.0
Melting point (^oc)	63.0	53.0	54.0	69.0

Draw a fully labelled phase diagram of the naphthalene - biphenyl system. (The melting points of naphthalene and biphenyl are 86°C and 71°C respectively) (04 marks)

c) Using the phase diagram above, determine the;

i) eutectic temperature. (01 mark)

41°C ✓ 01 ±1

ii) Composition of the eutectic mixture. (01 mark)

46.5% napthalene ±1 Accept: 46.5% napthalene and 53.5% biphenyl

d) Describe the changes that would take place if a liquid mixture of the above system containing 15% naphthalene was cooled from 90° C to room temperature. (05 marks)

When a liquid mixture containing 15% napthalene at point P(90°c) is cooled, it cools without a change in composition and phase to point Q(61°c) where biphenyl begins to solidify out of the liquid mixture.

On further cooling along QE, more biphenyl solidifies out of the liquid mixture as the composition of napthalene increases and freezing point decreases upto point E(41°c), eutectic point, where napthalene solidifies out to form a solid mixture at constant temperature and composition.

Further cooling along ER, the solid mixture cools without change in composition upto R(25°c), at room te

05

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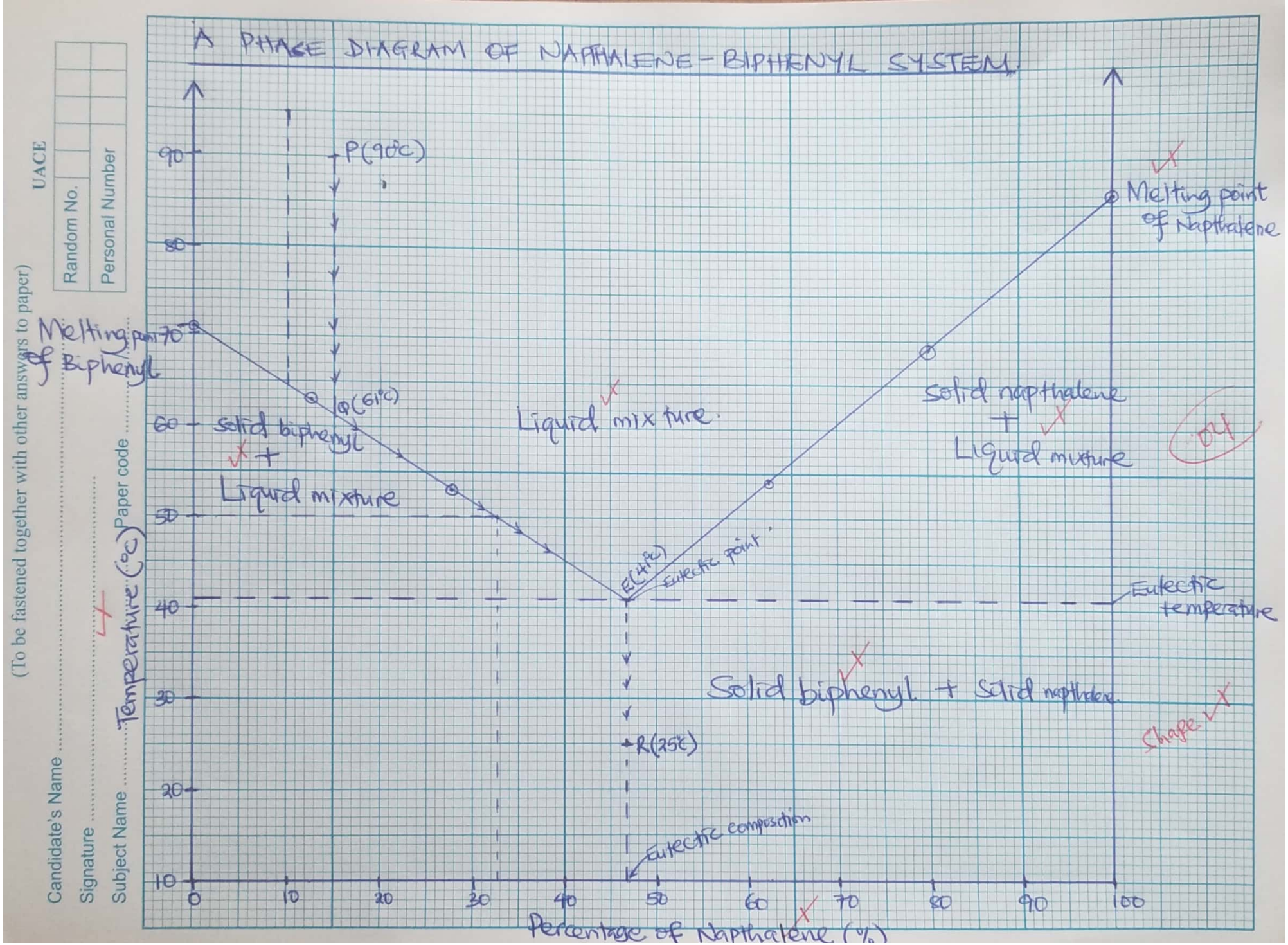
Random No.		Personal Number	

(To be fastened together with other answers to paper)

Candidate's Name .....

Signature .....

Subject Name ..... Paper code .....



d) Determine the mass of biphenyl that crystallises out if 200g of the liquid mixture containing 10% naphthalene is cooled from 95°C to 50°C. (04 marks)

Mass of napthalene in the liquid mixture before cooling $= \left(\frac{10}{100} \times 200\right) = 20g$

Composition of napthalene from the graph on cooling from 95°C to 50°C $= 32.5\%$ napthalene.

Let the mass of biphenyl be y

$$\frac{20}{y+20} = \frac{32.5}{100}$$

04

$y = 41.54g$

∴ Mass of biphenyl is 41.54g

e) State two differences between eutectic mixture and a pure compound. (02marks)

Eutectic mixture	Pure compound.
- Can be separated into its components by physical means	- Can not be separated by physical means.
- Its composition changes with pressure	- Fixed composition.
- Its melting point changes with pressure	- Fixed melting point.
- Microscopic examination shows it is heterogenous in composition.	- Microscopic examination shows its homogenous in composition

02

Any correct alternative

(f) (i) State two similarities between eutectic mixture and a pure compound. (02 marks)

- Both have sharp melting points.
- Both have similar cooling curves.

02

(g) (i) State one Test that can show that a eutectic mixture is not a pure compound. (01 mark)

- Microscopic examination shows that a eutectic mixture is heterogenous in crystals that make its composition.
- X-ray diffraction pattern of a eutectic mixture does not conform to that of pure compound.

01

Any correct alternative

(ii) State one application of eutectic mixtures.

In formation of alloys such as Brass, Solder, Bronze

01

END.