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INTERMEDIATE CERTIFICATE EXAMINATION, 1954.

SCIENCE (Syllabus A).

WEDNESDAY, 16th JUNE.—EVENING, 3 TO 5.

[Not more than *six* questions are to be attempted, of which *three* must be taken from Section I, and *three* from Section II. Illustrate your answers wherever possible.]

SECTION I.

1. State the principle of Archimedes and describe fully how you would demonstrate it by experiment in the case of a liquid other than water.

An object weighs 12.34 gms. in air and 10.24 gms. in water. Calculate (a) its volume, (b) its density.

[66 marks.]

2. Define :—(a) boiling point, (b) melting point.

What is the effect of changes of pressure (i) on the boiling point of water, (ii) on the melting point of ice ?

Sketch the apparatus you would use and explain how you would use it to measure the boiling point of water at a pressure above and, also, at a pressure below atmospheric pressure. Describe how you would measure approximately the pressure in one of those cases.

[66 marks.]

3. Define :—(a) specific heat, (b) calorie.

Describe how you would measure the specific heat of a liquid and mention the precautions you would take to obtain a reasonably accurate result.

In the case of a liquid of specific heat 0.6, calculate (i) the number of calories required to raise the temperature of 20 gms. of it from 10°C. to 40°C., (ii) the mass of it at 40°C. which would be required to raise the temperature of 36 gms. of copper (specific heat of copper = 0.1) from 15°C. to 25°C.

[66 marks.]

4. Sketch the apparatus you would use to investigate the relationship between the volume and pressure of a mass of air at constant temperature. Describe fully how you would use the apparatus and how you would establish the relationship from the measurements you would make.

A mass of air which is kept at constant temperature has a volume of 7,600 c.c. at a pressure of 500 mm. of mercury. What will its volume be at a pressure of 380 mm. of mercury ? If it has a volume of 5,000 c.c. at the pressure of the atmosphere, calculate the pressure of the atmosphere.

[67 marks.]

5. What is meant by "centre of gravity"?

Describe how you would find, by experiment, the centre of gravity of a thin piece of cardboard.

In the case of a laboratory balance explain, with the aid of a diagram, (a) why the centre of gravity of the beam should be below the point of support but not very much below it, (b) how the structure of the beam is suited to that feature of the balance.

[67 marks.]

SECTION II.

6. Describe, with the aid of a diagram, how you would prepare pure dry hydrogen, how you would burn it and how you would collect the product of combustion.

Mention three tests by means of which the product may be identified and state what information regarding its composition may be obtained from the above experiment.

[66 marks.]

7. Explain the following terms, giving one example in each case to illustrate your explanation:

- (a) saturated solution, (b) solubility, (c) distillation, (d) neutralization, (e) chemical equivalent of an element, (f) allotropy.

You are given a mixture of two liquids, one of which boils at 78°C . and the other at 100°C . Sketch the apparatus you would use and describe how you would use it to obtain a reasonably pure sample of each of the liquids.

[66 marks.]

8. Describe, with the aid of a diagram, how you would prepare and collect nitric oxide. Name the elements which it contains and give an account of its properties.

Describe and explain what may be observed when nitric oxide is passed into a gas jar filled with air and inverted in a trough of water.

[66 marks.]

9. Describe, with the aid of a diagram, (a) how you would prepare and collect oxygen, (b) how you would find the weight of a litre of it at S.T.P.

[67 marks.]

10. Describe what may be observed and name the products formed when

- (a) nitric acid is poured on limestone,
 (b) lime is mixed with hydrochloric acid,
 (c) carbon dioxide is passed into lime-water,
 (d) calcium is put into water,
 (e) a solution of washing soda in water is boiled after quicklime has been added to it.

In the case of (e) describe how you would attempt to obtain a reasonably pure sample of each of the products formed during the reaction.

[67 marks.]