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INTERMEDIATE CERTIFICATE EXAMINATION, 1955.

SCIENCE (Syllabus A).

WEDNESDAY, 15th 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. Define (*a*) density, (*b*) specific gravity.
Describe fully how you would measure the specific gravity of alcohol by using (i) a density bottle, (ii) a U-tube.

[66 marks.]

2. What is meant by the following terms :—(*a*) mass, (*b*) weight, (*c*) force ?
Describe, with the aid of a diagram, how you would (i) set up a spiral spring, (ii) measure the extensions produced by suspending various loads from it, (iii) investigate graphically the relationship between extension and load.
When two objects A and B are suspended together from a spiral spring, they produce an extension of 7 cms. When A is suspended by itself from the spring, it produces an extension of 4 cms. If B weighs 100 grams, find the weight of A.

[66 marks.]

3. Given an ungraduated thermometer, describe with the aid of diagrams, how you would graduate it to measure temperature in accordance with the Fahrenheit scale.
With regard to a thermometer, explain why the bore of the tube should be narrow and uniform.
Describe the absolute scale of temperature and explain its connection with Charles' Law. What reading on that scale corresponds to −22°F. ?

[66 marks.]

4. Define :—latent heat of steam.
Sketch the apparatus you would use to pass reasonably dry steam into a liquid in a calorimeter.
A calorimeter, of water equivalent 11 grams, contains 200 grams of water at 17°C. When 3·44 grams of dry steam at 100°C. are passed into the water, the temperature is raised to 27°C. Calculate the latent heat of steam.
In the above experiment, (*a*) how is the weight of the steam found, (*b*) why should the steam be as dry as possible, (*c*) how and why is heat exchange between the calorimeter and its surroundings prevented, as far as possible ?

[67 marks.]

5. Define coefficient of linear expansion.

A metal rod of length 50 cms. at 17°C. expands 0·68 mm. when heated from 17°C. to 97°C. Calculate the coefficient of linear expansion.

Sketch the apparatus you would use in the above experiment and explain carefully how the expansion is measured.

If a cube of this metal is heated from 17°C. to 97°C., what, to two significant figures, will be the percentage increase in its volume ?

[67 marks.]

Section II.

6. Describe and explain what may be observed when the following substances are exposed to the air for some time :—(*a*) a stick of caustic soda, (*b*) crystals of washing soda, (*c*) quicklime, (*d*) lime-water, (*e*) damp iron filings, (*f*) a piece of phosphorus.

What terms are used to indicate the phenomena in (*a*) and (*b*) ? What kind of change (physical or chemical) takes place in the case of (*d*) ?

[66 marks.]

7. Define the terms :—(i) solvent, (ii) solubility.

Describe fully how you would measure the solubility of a salt in water at 40°C.

Give a brief account, with the aid of a diagram, of how the solubility curve for a given salt is constructed.

[66 marks.]

8. Describe, with the aid of a diagram, how you would prepare a reasonably pure sample of nitric acid.

State its properties and describe how you would obtain from it (i) a sample of oxygen, (ii) a sample of nitric oxide. Describe and explain what would be observed if the two samples were mixed.

[66 marks.]

9. What is meant by (*a*) reduction, (*b*) chemical equivalent of an element ?

Describe fully, with the aid of a sketch of the apparatus, how you would prepare dry hydrogen and how you would find the decrease in weight when it is passed over a certain weight of hot copper oxide. Mention the precautions you would take in that experiment.

When excess of hydrogen is passed over 1 gram of heated copper oxide, there is a decrease in weight of 0·2 gram. Calculate the chemical equivalent of copper and, also, the weight of hydrogen used in the reaction.

[67 marks.]

10. Describe, with the aid of a sketch of the apparatus, how you would measure the percentage of carbon dioxide in a sample of chalk, by using an acid to displace the carbon dioxide.

If chalk contains 44% by weight of carbon dioxide and if a litre of carbon dioxide at S.T.P. weighs 1·98 grams, calculate the volume of carbon dioxide, measured at 15°C. and at a pressure of 76 cm. of mercury, which could be obtained from 2·73 grams of chalk.

[67 marks.]