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INTERMEDIATE CERTIFICATE EXAMINATION, 1940.

SCIENCE (Syllabus A)

WEDNESDAY, 19th JUNE.—AFTERNOON, 4 TO 6 P.M.

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

SECTION I.

1. State the Law of Flotation.

Describe fully an experiment you would perform in the laboratory to verify the Law in the case of a given liquid. A cork floats in water, having one-fifth of its total volume underneath the surface. What is the density of the cork ?

2. Describe fully how you would use a U tube to compare the densities of two liquids. Explain the method.

The column of mercury in a simple barometer is 29·2″ in height. Calculate the height of the column when the barometer is lowered perpendicularly into the sea so that the surface of the mercury in the trough is 2 ft. below the surface of the sea. (Sp. gr. of sea water =1·03 ; sp. gr. of mercury=13·6.)

3. Explain fully, with the aid of a diagram, how you would use a spiral spring, a suitable weight and a metre stick to determine the weight of a small stone.

When a stone is suspended from one end of a spiral spring the spring is extended 3 cm., but when the stone is completely immersed in water the spring is only extended 1·8 cm. Calculate the relative density of the stone.

4. Define " Latent Heat of Steam ".

When 3 gm. of steam at 100° C. are passed into 120 gm. of water in a copper calorimeter which weighs 30 gm., the temperature of the water is raised from 15° C. to 30° C. Calculate from these figures the latent heat of steam. (Specific heat of copper=·095.)

What precautions must be taken during the above experiment in order to obtain a reasonably accurate result ? Give reasons.

5. Describe fully how a thermometer may be constructed and graduated to read temperatures between 32° F. and 212° F. with reasonable accuracy.

Why is mercury generally used in the construction of a thermometer ? Explain your reasons carefully.

6. What do you understand by the coefficient of expansion of a gas at constant pressure ?

A column of dry air is enclosed in a narrow tube of uniform bore by means of a small thread of mercury. The length of the column of air is measured at various temperatures and the following results are obtained :

Length of column of air....	20cm.	20·55 cm.	20·9 cm.	21·4 cm.	22·08 cm.
Temperature of column of air	15° C.	23° C.	28° C.	35° C.	45° C.

Illustrate these results in the form of a graph.

What conclusion can be drawn from the graph ?

Use the graph to calculate the coefficient of expansion of air.

SECTION II.

7. Draw a diagram of the apparatus you would use to prepare and burn dry hydrogen in the air.

How would you perform the experiment and how would you collect the product of combustion ?

What tests may be carried out to identify the product of combustion ?

What information may be obtained from the above experiment regarding the composition of the product ?

8. What happens when

(*a*) oxygen is passed over heated carbon ?

(*b*) common salt is heated with sulphuric acid ?

(*c*) steam is passed over heated magnesium ?

(*d*) carbon dioxide is passed through lime-water ?

(*e*) green vitriol is strongly heated ?

Name all the products obtained in each case.

9. What is meant by the equivalent of an element ?

One gram of zinc displaces 370 c.c. of hydrogen at 15° C. and 740 m.m. pressure from a certain acid. Calculate the equivalent of zinc. Draw a diagram of the apparatus you would use to obtain this result experimentally, and explain how you would use it. [1000 c.c. of hydrogen at S.T.P. weigh ·09 grams.]

10. State the "Triangle of Forces".

You are given three small stones. Describe how you would use the Triangle of Forces to compare their weights.

Why is this experiment not always possible?

11. State the "Principle of Moments".

Give an accurate account of an experiment you would perform to verify the Principle.

A uniform metre stick whose weight is 100 gms. hangs horizontally from a piece of thread when masses of 50 gms. and 20 gms. are suspended from it at the 25 cm. and 65 cm. marks respectively. Calculate (*a*) the tension in the thread, (*b*) the position of the mark at which the stick is suspended from the thread.

12. Explain the following terms :—(*a*) work, (*b*) friction. A rough board 5 ft. in length is inclined at an angle of 30° to the ground. A force of 25 lbs. acting parallel to the board is just sufficient to drag a mass of 40 lbs. up along the board to the top. Calculate :—

(*a*) the work performed by the force of 25 lbs.

(*b*) the force of friction between the mass and the board.