

agent" and "reducing agent," and illustrate your definitions by reference to the experiments:—

(a) Sulphuretted hydrogen gas is passed into a solution of ferric chloride.

(b) Carbon is heated to a high temperature with ferric oxide.

(c) Sulphur dioxide is passed into a solution of permanganate of potash. Give equations.

4. (a) Dalton's gravimetric analysis of two compounds yielded the following results:—

Nitrogen 63.64. Nitrogen 46.67.

Oxygen 36.36. Oxygen 53.33.

Show the relation of these data to Dalton's formulæ for these substances (NO and NO_2).

(b) Gay Lussac's volumetric analysis of the mixture resulting from the decomposition of these same compounds gave the following results:—

Nitrogen $66\frac{2}{3}$ vols. Nitrogen 50 vols.

Oxygen $33\frac{1}{3}$ vols. Oxygen 50 vols.

Show the relation of these data to the present formulæ for these substances, and to Avogadro's law.

5. (a) Describe what takes place when:

(i) Iron is immersed in a solution of sulphate of copper,

(ii) Copper, in a solution of bichloride of mercury.

(iii) Zinc, in a solution of acetate of lead,

(iv) Magnesium, in a solution of nitrate of silver.

(b) Explain how quantitative results in these experiments can be used as an aid in determining atomic weights.

6. Describe simple laboratory methods of preparing small quantities of (a) metallic arsenic from the trioxide, (b) trichloride of antimony, (c) ferrous sulphate.

7. Sketch the chemistry of lead.

8. What is meant by the "Periodic Law?" Illustrate its significance by reference to the members of group

iv. (Carbon = 12, silicon = 28, tin = 118, lead = 207.)

9. Determine the acid and the base in the salt submitted.

PHYSICS.

NOTE—Experiments must be described in detail, must be capable of giving moderately accurate results, and be such as can be performed with simple apparatus.

1. (a) Define " g ," and give a method of determining it.

(b) Two masses, each 1 kilo, are attached to the ends of a light flexible string and hung over a pulley which moves very easily. Upon one mass a gram weight is put. Neglecting the mass of the string and pulley, find the space the weights will pass through in 10 seconds. [$g = 980$.]

2. (a) A steam-engine supplies power to a dynamo which is used to produce electric lights, and also to work a motor, which again runs a circular saw in a mill. Trace the transformation of energy as far as you can, beginning with the fuel fed to the engine.

(b) A body of mass 50 grams falls from a height 30 centimetres above the ground. Find the kinetic and the potential energy at any point on its way down, and hence show that the sum of these two quantities at all points in its path is the same as the energy at the highest point, or that on reaching the ground. [Give units.]

3. A stone is thrown at an angle of 60° with the horizontal with a velocity of 30 metres per second. Find the height it will rise and the range on the horizontal.

4. You wish to find the specific gravity of some oil, and have only a U-tube and a graduated ruler. Explain how you would do it.

5. (a) State Boyle's Law, and describe how to verify it.