

4. Equal triangles, upon equal bases in the same straight line, and towards the same parts, are between the same parallels.

Prove that if equal triangles are between the same parallels their bases are equal.

5. In any right-angled triangle, the square which is described upon the side subtending the right angle is equal to the squares described upon the sides which contain the right angle.

6. If a straight line be divided into any two parts, the squares of the whole line and of one of the parts are equal to twice the rectangle contained by the whole and that part, together with the square of the other part.

7. To divide a given straight line into two parts, so that the rectangle contained by the whole and one of the parts shall be equal to the square of the other part.

What lines in the figure, besides the given line, are divided in "medial section"?

Show that the greater segment of the given line will also be divided in medial section if a part be cut off from it equal to the less segment.

CLASS D.—CHEMISTRY (OPTIONAL).

Time allowed: Three hours.

1. How much chlorate of potash is required to yield 100 grammes of oxygen? ($K=39$; $Cl=35\frac{1}{2}$.)

2. Write down four equations to show how hydrogen is made.

3. Write down the names and symbols of the compounds which hydrogen forms with the other non-metallic elements.

4. State fully the properties of ammonia, carbon dioxide (CO_2), hydrosulphuric acid (H_2S), and chlorine.

5. How are the gases named in Question 4 made?

6. How would you distinguish from each other the following gases: Hydrogen, oxygen, nitrogen, chlorine?

7. State what you know of carbon under the following heads:—

(a.) How it occurs in nature;

(b.) Its allotropic modifications or different forms;

(c.) Its applications and uses.

8. Describe the process of making hydrochloric acid.

9. What is the composition of *sugar, water, alcohol, quartz, coal-gas, atmospheric air, phosphoric acid, gunpowder, rock-salt*?

10. Write down the names and symbols and atomic weights of twelve of the non-metallic elements.

11. Assign its atomicity (monad, dyad, triad, &c.) to each of the following elements: Oxygen, chlorine, sulphur, phosphorus, carbon, silicon, iodine, nitrogen.

12. How many grammes of nitrogen are contained in 100 grammes of nitric acid?

CLASS D.—ELECTRICITY (Optional).

Time allowed: Three hours.

1. Give a description of experiments to illustrate the magnetic inductive action of the earth upon soft iron.

2. How would you show that when a body is electrified by friction there are exactly equal quantities of negative and positive electricity produced?

3. Describe Faraday's ice-pail experiment, or some other experiment, to prove that the quantity of electricity induced by a body is equal to its charge.

4. How did Coulomb investigate the laws of electricity? State these laws, and describe Coulomb's torsion balance.

5. Give the meaning of the following terms: Electric potential, density, intensity of force, capacity, and quantity.

6. Describe various methods of producing voltaic electricity, and explain the advantages of Daniell's battery.

7. Describe the fundamental experiments of magneto-electric induction; and give an account of the construction of the telephone.

8. Describe the process of electrotyping and electroplating.

9. Describe three instruments for measuring an electric current, and state the special advantage of a voltmeter.

10. Describe some form of electro-magnetic engine.

CLASS D.—SOUND AND LIGHT (Optional).

Time allowed: Three hours.

1. Explain how sound is reflected and refracted. How is a sound-lens made?

2. Draw a section through an organ-pipe; explain the production of its notes; state the difference between a closed and an open pipe; and explain how an organ-pipe is tuned.

3. How is the velocity of sound in a solid body determined? Upon what does this velocity depend?

4. How is the difference between notes of the same pitch in the piano and organ explained? Describe either the synthetical or the analytical method of investigating a musical note.

5. Describe experiments to illustrate the fact that the intensity of light diminishes as the square of the distance. Explain some of the methods used to measure the intensity of light.

6. State the laws of reflection and refraction.

7. Explain the phenomena of total reflection, and give several examples.