

EA . Then AG , EF and HA are all equal, but angle at E is greater than angle at H ; therefore AH is greater than AE , and GK greater than FG ; therefore perimeter of rectangle is less than that of parallelogram, so that perimeter of square is less than that of any other parallelogram of equal area.

92. Let ABC be an isosceles triangle, AE perpendicular to the base BC , and $AECG$ the equivalent rectangle. Then AC is greater than DC , and AB is greater than AE . Hence the perimeter of $AECD$ is less than that of ABC .

100. The diagonals of a parallelogram bisect it, and it may easily be proved that they also bisect each other. Then in each of the four cases, if the line to bisect the parallelogram pass through the point where the diagonals intersect, what is required will be done.

SCIENCE.

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CHEMISTRY.

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V. "Write out the atomic and molecular equations representing the reactions occurring in the preparation of

- (i.) Oxygen from potassium chlorate.
- (ii.) Hydrogen from water by the action of sodium.
- (iii.) Nitrogen tetroxide by mixture of nitrogen dioxide with oxygen."

Ans.—(i.) (a) Atomic, $\text{KClO}_3 = \text{KCl} + \text{O}_3$.

(b) Molecular, $2\text{KClO}_3 = 2\text{KCl} + \text{O}_3$.

(ii.) (a) Atomic, $\text{H}_2\text{O} + \text{Na} = \text{HNaO} + \text{H}$.

(b) Molecular, $2\text{H}_2\text{O} + 2\text{Na} = 2\text{HNaO} + \text{H}_2$.

(iii.) (a) Atomic, $\text{NO} + \text{O} = \text{NO}_2$.

(b) Molecular, $2\text{NO} + \text{O}_2 = 2\text{NO}_2$.

VI. "Contrast the properties of oxygen, phosphorus and sulphur with those of their respective allotropic modifications.

Ans.—The allotropic modification of oxygen is called ozone. It possesses a peculiar smell, and is able to set free iodine from potassium iodide. Ozone has the most energetic oxidizing properties of any body we know. While common oxygen unites chemically with other bodies, principally at a high temperature, ozone oxidizes energetically at the ordinary temperature, and the substance at the same time reaches its highest state of oxidization. For instance, silver is changed by it into silver dioxide, phosphorus into phosphorus pentoxide, arsenic into arsenic pentoxide; sulphur, sulphuretted hydrogen and sulphur dioxide into sulphur trioxide, etc. Ozone is also a powerful bleaching agent in consequence of its oxidizing properties.

Two allotropic modifications of phosphorus.

(a) Yellow or common phosphorus is of a slightly yellow colour, resembling white wax in appearance and consistency; has a garlic-like smell; but at low temperatures it becomes brittle—s. g. 1.83 melts at 44° , heated to about 60°C . it takes fire. The white fumes it gives out in the dark, and which give a pale, phosphorescent light, consist of phosphorus trioxide, and are formed by the slow combustion of phosphorus. Phosphorus is insoluble in water, slightly soluble in oils, but readily soluble in carbon disulphide. Yellow phosphorus crystallizes out in rhombic dodecahedrons from solution in carbon disulphide.

(b) When yellow phosphorus is exposed to a temperature of about 240° for some hours in an atmosphere incapable of acting chemically upon it, it forms a dark red opaque substance, called *red amorphous phosphorus*. This modification of phosphorus is of a red colour, perfectly odourless; s. g. 2.11 does not melt below 250° —gives off no white phosphorescent fumes at the ordinary temperature. It is insoluble in carbon sulphide; may be obtained crystallized by heating it in a tube with metallic lead. The phosphorus dissolves in the melted lead, and on cooling separates out in crystals which possess a bright black metallic lustre.