(*b*) The sulphur dioxide extracts an atom of oxygen from the nitrogen peroxide thus :—$NO_2 + SO_2 = SO_3 + NO$.

(*c*) The heated sodium decomposes the carbon dioxide thus :—$CO_2 + 4 Na = C + 2Na_2O$; $2Na_2O + 2C O_2 = 2 Na_2CO_3$.

Combining these equations we have the equation representing the final result :

$$3CO_2 + 4Na = C + 2Na_2CO$$

6. Ferous sulphide (FeS) when strongly heated in air, yields ferric oxide and sulphur dioxide, the reaction being represented by the equation, $2FeS + 7 \cdot O = Fe_2O_3 + 2SO_2$.

7. Nitrogen $46.67 \div 14 = 3.33$
 Oxygen $53.33 \div 16 = 3\ 33$

The gases in this compound are in the proportion of 1 : 1. The density of the gas is 15, therefore its molecular weight is 30 ∴ the molecular formula is N.O.

8. (*a*) 30cc of chlorine unite with 30cc of hydrogen to form 60cc of hydrochloric acid gas. The gas resulting from the explosion will consist of 60cc of hydrochloric acid and 20cc of hydrogen.

(*b*) The sodium of the amalgam unites with the chlorine of the hydrochloric acid gas, and sets free 30cc of hydrogen thus :—$2Na + 2 Hcl = 2 Na\ Cl + H_2$.

(*c*) From these reactions we obtain the following relation of volumes.

30cc of Hydrogen and 30cc of chlorine form 60cc of hydrochloric acid gas. From this by Avagadro's hypothesis we deduce that 1 mol of H and 1 mol of Cl form 2 mols of HCl.

∴ ½ mol of H and ½ mol of Cl for 1 mol of HCl. So far as is known at present the hydrogen molecule has not been divided into more than two parts ; hence the hydrogen molecule is correctly represented by H_2.

III.

SOLUTIONS OF THREE EXAMPLES ON THE SENIOR LEAVING PAPER IN PHYSICS, JULY, 1895.

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1. (*b*) From formula

$$\text{acc.} = \frac{\text{moving force}}{\text{mass moved}} \cdot g$$

$a = \frac{1}{2001} \cdot 980$ cms $= \frac{980}{2001}$ cms.

space described $= \frac{at^2}{2} = \frac{980}{2001} \times {}^{100}/_{2} = \frac{49000}{2001} = 24.48$ cms.

2. (*b*) One erg of work is done when $\frac{1}{980}$ of a gram is lifted through 1 cm.

∴ When 50 grams are at a height of 30 cms their potential energy is $(50 \times 980) \times 30$ ergs (1).

In second place to find kinetic energy when it reaches the ground we need to know the velocity and time.

$30 = at^2/2$ when t = time of falling through 30 cms. ∴ $t = {}^1/_7 \sqrt{3}$ since $a = 980$. Than $v = at = 980 \times {}^1/_7 \sqrt{3}$

Therefore kinetic energy =

$$\frac{mv^2}{2} = \frac{50 \times (980 \times {}^1/_7 \sqrt{3})^2}{2}$$

$= 50 \times 980 \times 30$ ergs (2) same as in (1)

Again let us find the kinetic energy and potential when the body has fallen through h cms or at a distance of $(30 - h)$ from the ground.

When body has fallen through distance h then $h = at^2/2$ or $t = \sqrt{h/490}$. $v = at = 980 \times \sqrt{h/490}$.

∴ Kinetic energy =

$$\frac{mv^2}{2} = \frac{50}{2} \times (980 \times \sqrt{{}^h/_{490}})^2 =$$

$50 \times 980 \times h$ ergs.

Potential energy at height $(30 - h)$ cms $= 50 \times 980 \times (30 - h)$ which added to the kinetic gives $50 \times 980 \times 30$ ergs same as in (1) and (2).

3. A velocity of 30 meters at an angle of 60° to the horizon gives, on resolving, 15m as the initial horizontal and $15 \sqrt{3}$m as the initial vertical.