CBSE TEST PAPER-04

CLASS - XI CHEMISTRY

(Structure of Atom)

General Instruction:

- All questions are compulsory.
- Marks are given alongwith their questions.

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1. Define photoelectric effect. [1]
2. How does the intensity of light effect photoelectrons?
3. What is threshold frequency? [1]
4. Name the scientist who demonstrated photoelectric effect experiment. [1]
5. What did Einstein explain about photoelectric effect? [1]
6. What is the relation between kinetic energy and frequency of the photoelectrons? [2]
7. Calculate energy of 2 mole of photons of radiation whose frequency is $5 \times 10^{14} Hz$. [1]
8. What is emission and absorption spectra? [2]
9. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition, n = 4 to n = 2 of He^{+} spectrum? [2]
10. Spectral lines are regarded as the finger prints of the elements. Why? [2]

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CLASS - XI CHEMISTRY [ANSWERS]

Ans1. It is the phenomenon in which the surface of alkali metals like potassium and calcium emit electrons when a beam of light with high frequency is made to fall on them.

Ans2. The number of electron ejected and kinetic energy associated with them depend on the brightness of light.

Ans3. The minimum frequency below which photo electric effect is not observed is called threshold frequency (v_o)

Ans4. In 1887, H. Hertz demonstrated photo electric effect.

Ans5. Einstein in 1905 was able to explain the photoelectric effect using Planck's quantum theory of electromagnetic radiation.

Ans6. Kinetic energy of the ejected electron is proportional to the frequency of the electromagnetic radiation.

Ans7: Energy (E) of one photon = E = hv

Where $h = 6.626 \times 10^{-34} Js$

$v = 5 \times 10^{14} s^{-1}$

$\therefore E = \left(6.626 \times 10^{-34} \times 5 \times 10^{14}\right)$

$= 3.313 \times 10^{-19} J$

Energy of 2 mole of photon $= \left(3.313 \times 10^{-19} J\right) \times \left(2 \times 6.022 \times 10^{23} mol^{-1}\right)$

$= 3990.2 kJmol^{-1}$

Ans8. The spectrum of radiation emitted by a substance that has absorbed energy is called an emission spectrum.

When a sample of atomic vapors is placed in the path of white light from an arc lamp, it absorbs light of certain characteristic wave length and the light of other wavelength get transmitted. This produces a series of dark lines on a white background.

Ans9. For the Balmer transition, n = 4, to n = 2 in a He^+ ion, we can write.

$$\frac{1}{\lambda} = Z^2 R_H \left(\frac{1}{{n_1}^2} - \frac{1}{{n_2}^2}\right)$$

$$= Z^2 R_H \left(\frac{1}{2^2} - \frac{1}{4^2} \right)$$

$$= \frac{3}{4} R_H \text{--------} (i)$$

For a hydrogen atom

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{-------} (ii)$$

Equating equation (ii) and (i), we get

$$\frac{1}{n_1^2} - \frac{1}{n_2^2} = \frac{3}{4}$$

This equation gives $n_1 = 1$ and $n = 2$. Thus the transition $n = 2$ to $n = 1$ in hydrogen atom will have same wavelength as transition, $n = 4$ to $n = 2$ in He^+

Ans10. Spectral lines are regarded as the finger prints of the elements because the elements can be identified from these lines. Just like finger prints, the spectral lines of no two elements resemble each other.