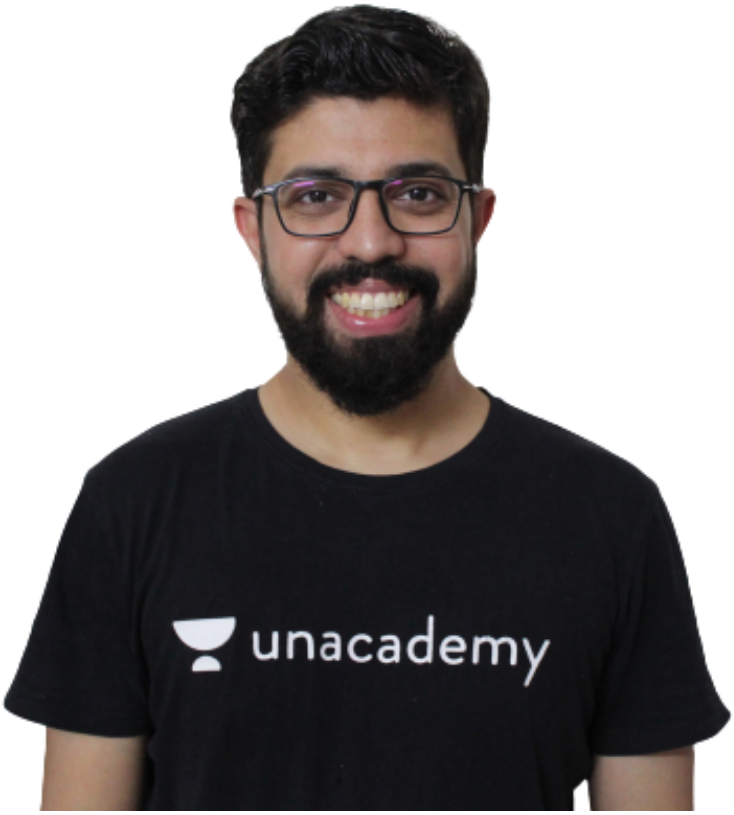
Atomic Structure

DPP-2



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1. Distinguish between (a) a proton and a photon (b) a photon and a quantum.

2. The longest and the shortest wavelengths of visible light are 7000Å and 4000Å calculate :

(a) wave number (b) J/mol (c) ergs/photon (d) frequency

(e) kcal/mol of photons.

3. For silver metal, the threshold frequency ν_0 is $1.13 \times 10^{+17}$ Hz. What is the maximum kinetic energy of the photo–electrons produced by shining ultraviolet light of 15.0 Å wavelength on the metal?

4. Calculate the kinetic energy of the electron emitted when light of frequency 3.0×10^{15} Hz is shone on a metal surface which has a threshold frequency 1.0×10^{15} Hz.

5. One photon of ultraviolet light can excite an electron from the surface of a certain metal. When the same metal surface is irradiated with 2 photons of red light having a total energy equal to that of the ultraviolet photon, no photoelectrons are produced. Explain these facts in terms of Planck's quantum theory Einstein's theory of photo electric effect.

6. The minimum energy necessary to overcome the attractive force between the electron and the surface of silver metal is 7.52×10^{-19} J. What will be the maximum kinetic energy of the electrons ejected from silver which is being irradiated with ultraviolet light having a wavelength 360 Å?

7. O_2 undergoes photochemical dissociation into 1 normal oxygen atom and 1 oxygen atom 1.967 eV more energetic than normal. The dissociation of O_2 into 2 normal oxygen atoms is known to require 498 kJ/mol O_2. What is the maximum wavelength effective for the photochemical dissociation of O_2?

8. (a) What change in energy per mol of atoms would be associated if 1 atom gives a radiation at 1 Hz?

(b) What is the relationship between the electron volt and the wavelength in nm of the energetically equivalent photon?

9. An electron volt (eV) is the energy necessary to move an electronic charge (e) through a potential of exactly 1 V. Express this energy in (a) J (b) kcal per mole of electrons (c) kJ per mole of electrons.

10. What is the number of photons of light with a wavelength of 4000 pm that provide 1J of energy ? **(NCERT Problem)**

11. A photon of wavelength 4×10^{-7} m strikes on metal surface, the work function of the metal being 2.13 eV. Calculate

(i) the energy of the photon (eV),

(ii) the kinetic energy of the emission, and

(iii) the velocity of the photoelectron **(NCERT Problem)**

12. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionise the sodium atom. Calculate the ionisation energy of sodium in kJ mol^{-1}. **(NCERT Problem)**

13. The ratio of the energy of a photon of 2000 Å wavelength radiation to that of 4000 Å radiation is

(a) 1/4 (b) 4 (c) 1/2 (d) 2

14. When light of frequency 3.2×10^{16} Hz is used to irradiate a metal surface, the maximum kinetic energy of the emitted photoelectron is 3/4 of the energy of the irradiating photon. What is the threshold frequency of the metal ?

(a) 2.4×10^{25} Hz (b) 2.4×10^{16} Hz (c) 1.6×10^{15} Hz (d) 8×10^{15} Hz

15. The value of one quantum of energy is represented by

(a) E = hv (b) $E = \lambda v$ (c) E = mv (d) none of these

16. Which one of the following is not the characteristic of Planck's quantum theory of radiation

(a) The energy is not absorbed or emitted in whole number multiple of quantum

(b) Radiation is associated with energy

(c) Radiation energy is not emitted or absorbed continuously but in the form of small packets called quanta

(d) This magnitude of energy associated with a quantum is proportional to the frequency

17. The Planck constant has the dimension of

(a) Length (b) Energy

(c) Momentum (d) Angular momentum

18. The frequency of yellow light having wavelength 600 nm is

(a) 5.0×10^{14} Hz (b) 2.5×10^{7} Hz (c) 5.0×10^{7} Hz (d) 2.5×10^{14} Hz

ANSWERS

2. **(a)** $1.43\times10^{6}\ m^{-1}$, $2.5\times10^{6}\ m^{-1}$ **(b)** 171.11×10^{3} J/mol , 2.99×10^{5} J/mol

(c) 2.84×10^{-12} erg/photon, 4.97×10^{-12} ergs

(d) 4.29×10^{14} Hz, 7.5×10^{14} Hz **(e)** 40.8 KCal/mol, 71.5 KCal/mol.

3. KE = 5.7×10^{-17}J **4.** KE = 1.326×10^{-18}J

6. 4.767×10^{-18}J **7.** 173.7 nm

8. **(a)** 3.99×10^{-10}J/mol, **(b)** 1eV = 2.413×10^{14}Hz (photons)

9. **(a)** 1.6×10^{-19}J, **(b)** 23 KCal/mol. **(c)** 96.4 KJ/mol.

10. 2.012×10^{16} photons

11. **(i)** 4.95×10^{-19} J (3.09 eV), **(ii)** 0.96 eV, **(iii)** $5.81 \times 10^{5}\ ms^{-1}$

12. 494 kJ mol^{-1}

13. (d) **14.** (d) **15.** (a) **16.** (a)

17. (d) **18.** (a)