Transweb Educational Services Pvt Ltd
B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

Class: XII
Subject: Physics
Topic: Dual Nature of Matter
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. De Broglie wavelength of proton of mass 1.6×10^{-27} kg accelerated through a p.d. of 1 kV is\
a. 0.9×10^{-9} m
b. 7.0×10^{-10} m
c. 0.9×10^{-12} m
d. 600×10^{-10} m

Ans. C

Solution:

$$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2meV}}$$
$$= \frac{6.6 \times 10^{-34}}{\sqrt{2 \times 1.6 \times 10^{-27} \times 10^{3} \times 1.6 \times 10^{-19}}}$$
$$= \frac{6.6 \times 10^{-34}}{\sqrt{20 \times 1.6}} \times 10^{-12} = 0.9 \times 10^{-22} m.$$

2. In the case of Hydrogen atom the ratio of energy difference between second orbit and third orbit to the energy difference between the first orbit and the second orbit is
a. 9/4
b. 4/9
c. 5/27
d. 27/5

Ans. C

Energy difference between second and third orbit

$$= 13.6\left[\frac{1}{4} - \frac{1}{9}\right] = 13.6 \times \frac{5}{36}$$

Energy difference between first and second orbit $= 13.6 \times \frac{3}{4}$

$$\therefore \text{Ratio is } \frac{5}{36} \times \frac{4}{3} = \frac{5}{27}.$$

Transweb Educational Services Pvt Ltd
B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

3. The hydrogen atoms are excited to stationary state designated by the principal quantum number n = 4. The spectral lines emitted by hydrogen atoms as explained from Bohr's theory will be
a. 3
b. 2
c. 10
d. 6

Ans. D
Solution:
4 - 3, 3 - 2,3 -1, 2 -1, 4 - 2, 4 -1 transit ions Total 6.

4. An electron in a H-atom undergoes a transition from an excited state to the ground state. The statement that is true is
a. Its kinetic energy increases and its potential and total energy decreases
b. Its kinetic energy decreases potential energy increases and total energy
c. Its kinetic and total energy decrases, potential energy increases
d. Its kinetic potential and total energy decrases

Ans. A

5. An electric or magnetic field can’t accelerate
a. α – particle
b. proton
c. neutron
d. electron

Ans. C
6. Matter waves are
a. elastic waves
b. mechanical waves
c. e.m. waves
d. waves which have mathematical existence with physical significance
Ans. D

7. Energy of photon of radiation of wavelength 6625 Å is
a. 3.1 eV
b. 1.875 eV
c. 6.625 eV
d. 3.1875 eV

Ans. B

Solution:

$$E = \frac{hc}{\lambda \times 1.6 \times 10^{-19}} = \frac{6.625 \times 10^{-34} \times 3 \times 10^{8}}{6.625 \times 10^{-7} \times 1.6 \times 10^{-19}}$$

$$\frac{6.625 \times 3}{6.625 \times 1.6} = 1.875 \ eV$$

Note : If you express wavelength in terms of 10^{-7} in $\left(\frac{hc}{\lambda}\right)$ calculations in eV, powers of ten won't appear in further steps.

8. Stopping voltage in photoelectric effect depends on
a. frequency of incident photon
b. nature of the surface of the metal only
c. intensity of the incident light only
d. both 1 and 2
   Ans. A

9. The de-Broglie wavelength associated with proton changes by 0.25% if its momentum is changed by pï. The initial momentum was
a. 100 pï
b. $p_o / 400$
c. 401 pï
d. $p_o / 100$

   Ans. C
   Solution:

$$\text{We know } \lambda = \frac{h}{p}\text{..............................(1)}$$

$$\left(\lambda + \frac{0.25\lambda}{100}\right) = \frac{h}{(P - P_o)} \Rightarrow \frac{100 - 25\lambda}{100} = \frac{h}{P - P_o}\text{....................(2)}$$

$$\text{From eqs (1) and (2) we get } \frac{100.25}{100} = \frac{P}{P - P_o}$$

Solving we get $p = 401 P_o$

10. Matter wave hypothesis was experimentally confirmed by electron diffraction experiments of
a. J.J. Thomson
b. Milikan
c. G.P. Thomson
d. de Broglie

   Ans. C

11. Continuous spectrum is
a. independent of the material and temperature from which light is emitted
b. independent of the material and dependent on temperature of the material from which light is emitted
c. dependent on material and its temperature from which light is emitted
d. dependent on material and independent of its temperature from which light is emitted

Ans. B

12. Light of wavelength 5000Å falls on a sensitive plate with photo electric work function equal to1.9 eV. Frequency of photon is
a. 6×10^{14}
b. 6×10^{10}
c. 3×10^{10}
d. 6×10^{16}

Ans. A

Solution:

$$f = \frac{c}{\lambda} = \frac{3\times10^{8}}{5\times10^{-7}} = 0.6\times10^{15} = 6\times10^{14}\,Hz$$

13. A positrpnium atom consists of an electron revolving around a positron. In the ground state, the ratio of the size of this hypothetical atom to the hydrogen atom is
a. 1
b. 1.5
c. 2
d. <1

Ans. C
Solution:
The reduced mass of e in the positroniu matom is

$$\mathrm{m_e} = \frac{(m)(m)}{(m+m)} = \frac{m}{2}$$

$$\text{Since } \mathrm{r_n} = 4\pi \in_o \frac{n^2h^2}{4\pi^2 \mathrm{m_e} Ze^2} \Rightarrow r_n \alpha \frac{1}{\mathrm{m_e}}$$

$$So(r_n)_{positronium} = 2(r_n)_{hydrogen}$$

Transweb Educational Services Pvt Ltd
B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

14. According to Bohr's model of H2 atom, the radii of stationary orbits are
a. proportional to quantum numbers
b. proportional to square of quantum numbers
c. inversely proportional to the quantum numbers
d. inversely proportional to the square of quantum numbers

Ans. B

15. The velocity of electron accelerated through a p.d. of 4500 V is
a. 4×10^7 m/s
b. 16×10^7 m/s
c. 4×10^8 m/s
d. 8×10^7 m/s

Ans. A
Solution:

$$\frac{1}{2}mv^2 = eV$$

$$v = \sqrt{\frac{2eV}{m}} = \sqrt{\frac{2 \times 1.6 \times 10^{-19} \times 4500}{9.1 \times 10^{-31}}}$$

$$= \sqrt{\frac{2 \times 1.6 \times 4500}{9.1}} \times 10^6 = 3.9 \times 10^7 = 4 \times 10^7\ m/s$$

16. Photo-electric effect supports quantum nature of light because
a. there is a maximum frequency of light below which no photo-electrons are emitted
b. the maximum kinetic energy of photo electrons depends only on the frequency of light and not on its intensity
c. even when the metal surface is faintly illuminated the photo-electrons leave the surface immediately
d. electric charge of photoelectrons is quantized
Ans. C

17. If electron in an hydrogen atom jumps from an outer orbit n = 3 to an inner orbit n = 2, the emitted radiation has a wavelength given by
a. $\lambda = \frac{R}{6^2}$
b. $\lambda = \frac{6^2}{R}$
c. $\lambda = \frac{5R}{36}$

d. $\lambda = \frac{36}{5R}$

Ans. D
Solution:

$$\frac{1}{\lambda} = RZ^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$
$$\frac{1}{\lambda} = R\left[\frac{1}{2^2} - \frac{1}{3^2}\right] = R\left[\frac{1}{4} - \frac{1}{9}\right] = R \times \frac{5}{36}$$
$$\lambda = \frac{36}{5} \times \frac{1}{R}.$$

18. The angular momentum of the electron in the third Bohr orbit is
a. h
b. $\frac{3h}{2\pi}$
c. $\frac{h}{2\pi}$
d. $\frac{h}{4\pi}$
Ans. B

19. Maximum velocity of photoelectrons emitted by a photo emitter is 1.8 x 106 m/s. Taking $\frac{e}{m} = 1.8 \times$ 10 for electrons, the stopping potential of the emitter is
a. 9 V
b. 11.8 V
c. 1.8 V
d. 10 V

Ans. A
Solution;

$$\text{Stopping potential} = \frac{1}{2}mv^2 J. = \frac{1}{2}\frac{mv^2}{e}eV$$
$$= \frac{1}{2}\frac{v^2}{(\frac{e}{m})} = \frac{1}{2} \times \frac{(1.8\times10^6)^2}{1.8\times10^{11}} = 9\ eV.$$
$$\therefore \text{Stopping potential} = 9\text{V}$$

20. Following is the source of U - V rays
a. point lite lamp
b. radioactive substance
c. electric arc
d. all of these
Ans. C