Gazette's Educational Supplement

PHYSICS 3rd Sec.

Physics Teacher

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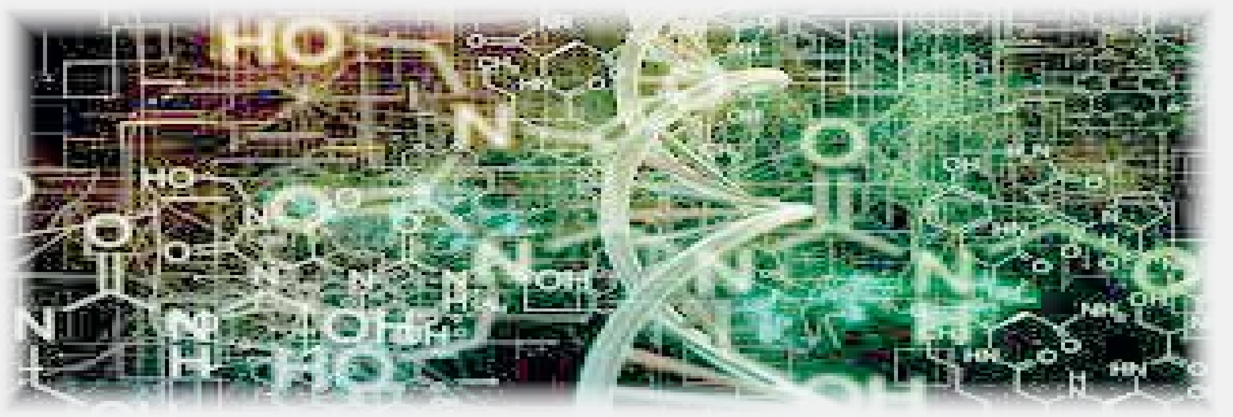
Educational Consultant

Awatef Ahmed



Revision on ch 7 ,6 ,5

(1)In Compton Effect, when a photon of γ-ray collides with a free electron moving with velocity (v),

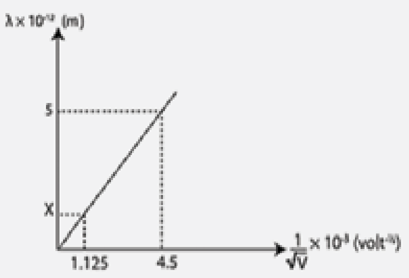
	The momentum of the electron	The momentum of the scattered photon
A	increases	increases
B	decreases	decreases
C	increases	decreases
D	decreases	increases

so...

The correct answer is (c)

On collision the velocity of electron increases so, the momentum of electron increases, while the wave length of photon increases, so its frequency and energy are decreased then its mass is decreased and it's mass too.

(2) The graph represents the relation between the reciprocal of the square root of the electric potential difference used in the cathode ray tube and the associating wavelength for the electrons emitted from the tube filament, so the value of the point (X) on the graph equals ....



a) 3×10^{-12} m b) 5×10^{-10} m c) 6×10^{-12} m d) 1.25×10^{-12}

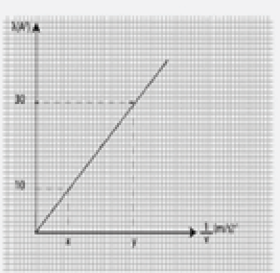
The correct answer is 1.25×10^{-12} m

Because, from the calculation of the slope $= \frac{5\times10^{-12}}{4.5\times10^{-3}} = 1.11\times10^{-9}$ =constant

$\frac{x}{1.125\times10^{-3}} = 1.11\times10^{-9} \rightarrow X = 1.25\times10^{-12}$ m

(3) The graph represents the relation between the wavelength for the electrons emitted from the tube filament and the reciprocal of the velocity of the electrons, so, the ratio between:

$\frac{\text{the velocity of the electron at (x)}}{\text{the velocity of the electron at (y)}}$ (m_e=9.1× 10^{-31}Kg & h=6.625× 10^{-34} J.s)

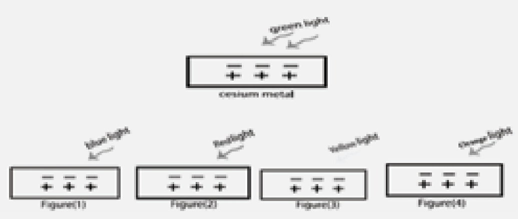


a) $\frac{9}{1}$ b) $\frac{1}{9}$ c) $\frac{3}{1}$ d) $\frac{1}{3}$

The correct answer is: 3/1

Because, $\frac{V_x}{V_y} = \frac{\lambda_y}{\lambda_x}$ ∴ $\frac{V_x}{V_y} = \frac{30}{10} = \frac{3}{1}$

(4) The opposite figure represents a green light falling on the surface of Cesium metal, where electrons barley liberated with zero K.E. in which figure from the following represents electrons will be liberated gained K.E.



The correct answer is blue

Because, blue color only has more energy than green color.

(5) An electron microscope is used to examine two different viruses (X) and (Y). If the dimension of virus (X) is 1 nm while that of virus (Y) is 4 nm. Then, the ratio between:

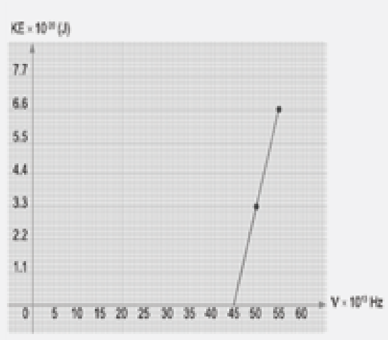
$\frac{\text{The required potential difference between anode and cathode to observe virus (X)}}{\text{The required potential difference between anode and cathode to observe virus (y)}}$

a) 16 b) 8 c) 4 d) 2

The correct answer is: 16

Because, $\lambda = \frac{h}{mxv}$ & V= $\sqrt{\frac{2eV}{m}}$ $\rightarrow \lambda \propto \frac{1}{\sqrt{volt}}$ ∴ $\frac{Volt_{(x)}}{Volt_{(y)}} = \frac{\lambda_y^2}{\lambda_x^2} = \frac{4^2}{1^2} = 16$

(6) The opposite graph represents the relation between the kinetic energy of electrons emit from photo electric cell and the frequency of incident photon on the cathode, Which one of the following wave lengths emits electrons with kinetic energy = 6.6× 10^{-20} J (C= 3× 10^8 m/s)



a) 5.45× 10^{-7} m b) 5.55 × 10^{-7} m

c) 5.54 × 10^{-7}m d) 5.65× 10^{-7}m

The correct answer: 5.45× 10^{-7} m

Because, from the graph the value of critical frequency υ_c = 45 × 10^{13}Hz.

Then, $E_w = h\upsilon_c$ & K.E = E - $E_w = \frac{hc}{\lambda} \rightarrow E = \frac{hc}{\lambda}$ = K.E + E_w

$\lambda = \frac{hc}{K.E + E_w} = \frac{6.625\times10^{-34}\times3\times10^8}{6.6\times10^{-20}+(6.625\times10^{-34}\times45\times10^{13})} = 5.45\times10^{-7}$m.

(7) In Coolidge tube, if the velocity of the electrons colliding with the target is 7.34x10^6 m/s, so the minimum wavelength of the produced x-rays spectrum equals ....

Knowing that: h=6.625x10^{-34} J.s , me=9.1x10^{-31} kg, C=3x10^8 m/s

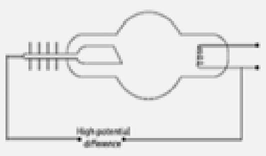
a) 8.11 nm b) 0.811× 10^{-9} c) 0.059nm d) 5.9 × 10^{-10}

The correct answer is: 8.11 nm

Because, $E = \frac{hc}{\lambda_{min}} = \frac{1}{2}mv^2 \rightarrow \lambda_{min} = \frac{hc}{\frac{1}{2}mv^2} = \frac{6.625\times10^{-34}\times3\times10^8}{0.5\times9.1\times10^{-31}\times(7.34\times10^6)^2}$

$\lambda_{min} \approx 8.11\times10^{-9}$m =8.11nm.

(8) In Coolidge tube in the figure, to produce X-rays. If the atomic number of the target material is (42). So, to produce the longest wavelength for the characteristic X-rays radiation, we must change the target material to another element of atomic no. ....

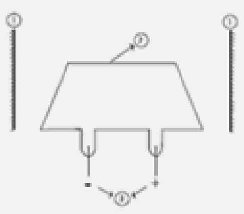


a) 29 b) 74 c) 82 d) 55

The correct answer is: 29

Because, by increasing the atomic number the wave length of the characteristic radiation and vice versa.

(9) The schematic diagram represents the apparatus of (He-Ne) laser production, which choice correctly represents the role of each of the components (1, 2 and 3)?



	Number 1	Number 2	Number 3
A	Photons production	High voltage production	Reflecting photons
B	Reflecting photons	Contains the active medium	High voltage production
C	Pumping energy to excite the atoms	exciting the Neon atoms	Amplifying photons
D	LASER photons production	The used energy source	exciting the Neon atoms

The correct answer is B

Because, 1) mirrors 2) resonance cavity c) source of energy

(10) In Rubby-Chromium LASER, string Xenon bulbs are used to excite the atoms of the active medium, so the ratio between

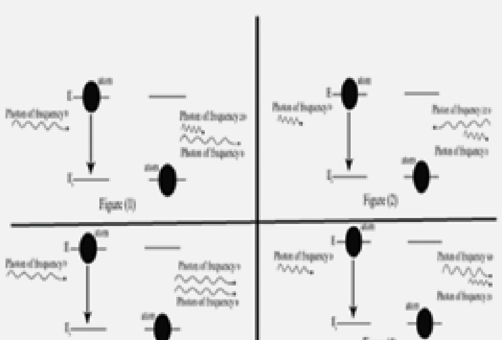
$\frac{\text{the speed of produced LASER ray in air}}{\text{the speed of Xenon lamp light in air}}$ = ...

a) One b) more than one c) less than one d) zero

The correct answer is: one

Because the velocity of photon is constant c= 3× 10^8 m/s.

(11) The figure that represents stimulated emission is figure no. ....

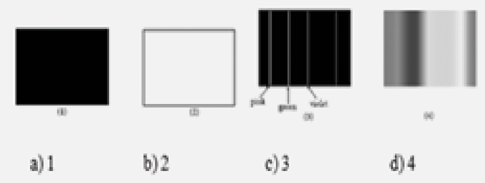


a) 1 b) 2 c) 3 d) 4

The correct answer is: 3

Because, the emitted photons are produced by the stimulated emission are in phase.

12) Which figure represent the spectrum resulting from the excited Hydrogen gas?



a) 1 b) 2 c) 3 d) 4

The correct answer is: 3

Because, the Emission line spectrum, they appear on spectrograph as bright, lines on a black background.

(13) The force applied by a beam of light whose power is 1W on the surface Of the wall is.........................N.

a) 0.67 x 10^{-8} b) 787 x 10^{-8} c) 0.21 x 10^{-8} d) 69 x 10^{-8}

The correct answer is: 0.67 x 10^{-8}

Because, $F = \frac{2P_w}{c} = \frac{2\times1}{3\times10^8} = 0.67\times10^{-8}$ N

(14) The photon mass and linear momentum if λ = 380 nm. are ....and ....respectively. Given h = 6.625 x 10^{-34} J.S

a) 5.81 x 10^{-36} Kg and 1.74 x 10^{-27} Kg ms^{-1}

b) 1.74 x 10^{-27} Kg and 5.81 x 10^{-36} Kg ms^{-1}

c) 2.55 x 10^{-36} Kg and 5.66 x 10^{-36} Kg ms^{-1}

d) 3.66 x 10^{-36} Kg and 5.66 x 10^{-36} Kg ms^{-1}

The correct answer is 5.81 x 10^{-36} Kg and 1.74 x 10^{-27} Kg ms^{-1}

Because,

$m = \frac{E}{c^2} = \frac{h\upsilon}{c^2} = \frac{h}{c\lambda} = \frac{6.625\times10^{-34}}{3\times10^8\times380\times10^{-9}} = 5.81\times10^{-36}$ Kg

$\lambda = \frac{h}{P_L}$ ⇒ $P_L = \frac{h}{\lambda} = \frac{6.625\times10^{-34}}{380\times10^{-9}} = 1.74\times10^{-27}$ Kg ms^{-1}

(15) If the work function of sodium metal is 3.68 x 10^{-19}J, then the longest wavelength of radiation necessary to emit photoelectrons from it is........

a) 5.4 x 10^{-7}m b) 6.6 x 10^{-9}m c) 9.9 x 10^{-7}m d) 2.33 x 10^{-9}m

The correct answer is: 5.4 x 10^{-7}m

Because, $E_w = h\upsilon_c = \frac{hc}{\lambda_c}$

$\lambda_c = \frac{6.625\times10^{-34}\times3\times10^8}{3.68\times10^{-19}} = 5.4\times10^{-7}$m

(18) A radio station emits a wave frequency 92.4 MHz, the rate of photon ($\emptyset_L$) if the power of the station is 11 KW is.........................

a) 4.116 × $10^{29}S^{-1}$ b) 3.116 × $10^{29}S^{-1}$

c) 1.796 × $10^{29}S^{-1}$ d) 5.6 × $10^{29}S^{-1}$

The correct answer is: 1.796 × $10^{29}S^{-1}$

Because, E = hυ

E = 6.625 × 10^{-34} × 92.4 × 10^6 E = 6.1215 × 10^{-26} J

$P_w = \frac{E}{t} = E\emptyset_L$

$\emptyset_L = \frac{P_w}{E} = \frac{11\times1000}{6.1215} = 1.796\times10^{29}S^{-1}$

(17) An x-rays photon of wavelength 3A° collides an electron at rest. The electron is ejected with energy = 1.01 x 10^{-16}J. then the wavelength of the scattered photon is ....

a) 3.6 A° b) 6.3 A° c) 7 A° d) 8.6 A°

The correct answer is :3.6 A°

Because

Energy before collision = Energy after collision

$\underset{photon}{h\frac{c}{\lambda}} + \underset{electron}{\frac{1}{2}mv^2} = \underset{photon}{h\frac{c}{\lambda}} + \underset{electron}{\frac{1}{2}mv^2}$

$\frac{6.625\times10^{-34}\times3\times10^8}{3\times10^{-10}} + 0 = \frac{6.625\times10^{-34}\times3\times10^8}{\lambda} + (1.01\times10^{-16})$

$\frac{1.9875\times10^{-25}}{3\times10^{-10}} = \frac{1.9875\times10^{-25}}{\lambda} + (1.01\times10^{-16})$

$5.524\times10^{-16} = \frac{1.9875\times10^{-25}}{\lambda}$

$\lambda = 0.3598\times10^{-9}$m = 3.6 A°

(18) A radio station emits a wave frequency 92.4 MHz, the rate of photon ($\emptyset_L$) if the power of the station is 11 KW is.........................

a) 4.116 × $10^{29}S^{-1}$ b) 3.116 × $10^{29}S^{-1}$

c) 1.796 × $10^{29}S^{-1}$ d) 5.6 × $10^{29}S^{-1}$

The correct answer is: 1.796 × $10^{29}S^{-1}$

Because, E = hυ

E = 6.625 × 10^{-34} × 92.4 × 10^6 E = 6.1215 × 10^{-26} J

$P_w = \frac{E}{t} = E\emptyset_L$

$\emptyset_L = \frac{P_w}{E} = \frac{11\times1000}{6.1215} = 1.796\times10^{29}S^{-1}$

(19) The minimum value of the accelerating voltage that would be required for an electron to give up all of its energy in a collision with a target and produce x-ray of wavelength 0.03 nm is.........................volt.

a) 7716.25 b) 656.25 c) 5506.25 d) 41406.25

The correct answer is: 41406.25

Because, $eV = h\frac{c}{\lambda}$

$1.6\times10^{-19}V = \frac{6.625\times10^{-34}\times3\times10^8}{0.03\times10^{-9}}$

V = 41406.25 Volt

(20) An electron of mass 9 x 10^{-31} kg moving with velocity of 2.7 x 10^6 Km/hour and a proton of mass 1.5 x 10^{-27}kg moving with velocity 8.1 x 10^5km/hour, then the ratio of wavelengths of their accompanying waves is.........................

a) $\frac{200}{1}$ b) $\frac{300}{1}$ c) $\frac{400}{1}$ d) $\frac{500}{1}$

The correct answer is : $\frac{500}{1}$

Because, $\lambda = \frac{h}{mv}$

$\lambda_1 = \frac{6.625\times10^{-34}\times18}{9\times10^{-31}\times2.7\times10^6\times5} = 9.8\times10^{-10}$m

$\lambda_2 = \frac{6.625\times10^{-34}\times18}{1.5\times10^{-27}\times8.1\times10^5\times5} = 1.96\times10^{-12}$m

$ratio = \frac{\lambda_1}{\lambda_2} = \frac{500}{1}$

(21) If the ratio between the velocities of two moving bodies is 10:3 and the ratio between their wavelengths is 1:25, then the ratio between their masses is.......

a) 15:2 b) 20:1 c) 10:3 d) 23:25

The correct answer is 15:2

Because, $\lambda = \frac{h}{mv}$

λm x v = Constant.

$m = \frac{Constant}{\lambda v}$

$\frac{m_1}{m_2} = \frac{\lambda_2\times v_2}{\lambda_1\times v_1} = \frac{3}{10}\times\frac{25}{1} = \frac{15}{2}$

(22) The potential difference necessary to make the velocity of the proton equal to the velocity of an electron accelerated under potential difference of 1000 volts is.............................. volts.

(If mass of proton = 1.67 x 10^{-27} kg and mass of electron = 9.1 x 10^{-31} kg)

a) 1.835 x 10^6 b) 2.13x 10^6 c) 3.26 x 10^6 d) 63.2 x 10^6

The correct answer is: 1.835 x 10^6

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

$v^2 = \frac{eV}{m}$

$\left(\frac{eV}{m}\right)_{Proton} = \left(\frac{eV}{m}\right)_{ers}$

$\frac{V_p}{m_p} = \frac{V_e}{m_e}$; $m \propto \frac{1}{V}$

$\frac{m_p}{m_e} = \frac{V_p}{V_e}$

$\frac{1.67\times10^{-27}}{9.1\times10^{-31}} = \frac{V_p}{1000}$

$V_p = 1.835\times10^6$m/s

(23) The frequency and wavelength of the emitted radiation (photon) when an electron in the hydrogen atom is transferred from the forth shell of the energy E_4 = - 0.85 eV to the third shell of Energy E_3 = -1.5eV are ....respectivly.

(knowing that: e = 1.6 x 10^{-19}C , h = 6.625 x 10^{-34} J.S)

a) 1.5698 x 10^{14} Hz and 1.911 x 10^{-6} m

b) 1.911 x 10^{-6} x 10^{14} Hz and 1.5698 x 10^{14}m

c) 2.23 x 10^{14} Hz and 4.5698 x 10^{-6} m

d) 3.868 x 10^{14} Hz and 1.911 x 10^{-6} m

The correct answer is 1.5698 x 10^{14} Hz and 1.911 x 10^{-6} m

Because, $\Delta E = E_4 - E_3$ = - 0.85 – (- 1.5) = 0.65 eV

$\Delta E = h\upsilon$ ➡ 0.65 x 1.6 x 10^{-19} = 6.625 x 10^{-34} x υ

∴ υ = 1.5698 x 10^{14} Hz.

$\lambda = \frac{c}{\upsilon} = \frac{3\times10^8}{1.5698\times10^{14}} = 1.911\times10^{-6}$ m

(24) The longest and the shortest wavelength in Lyman's series of hydrogen atom spectrum are ....and ....respectivly.

knowing that the energy of shells inside the hydrogen atom is given by: $E_n = \frac{-13.6}{n^2}$ e.V, h=6.625× 10^{-34}j.s, C= 3× 10^8m/s, and e= 1.6× 10^{-19}C.

a) 910A ,1213.2A b) 1213.2A,910A

c) 550A ,1300A d) 1300A,550A

The correct answer is 1213.2A,910A

Because,

For the longest wavelength the electron transfers from E_2 (n = 2) to E_1 (n =1)

$E_2 = \frac{-13.6}{(2)^2}$ = - 3.4 eV , E_1 = - 13.6 eV

$\Delta E = E_2 - E_1$ = - 3.4 – (-13.6) = 10.2 eV

$\Delta E = h\upsilon = h\frac{c}{\lambda}$ ➡ 10.2 x 1.6 x $10^{-19} = \frac{6.625\times10^{-34}\times3\times10^8}{\lambda}$

λ = 1.2132 x 10^{-7}m = 1213.2 A°

For the shortest wavelength electron transfers from n = ∞ (free electron) to E_1 (n = 1) ; E_∞ = 0

E_1 = - 13.6 eV

∴ $\Delta E = E_\infty - E_1$ = 0 – (-13.6) = 13.6 eV

∴ 13.6 x 1.6 x $10^{-19} = \frac{6.625\times10^{-34}\times3\times10^8}{\lambda}$; λ = 9.1 x 10^{-8}m = 910 A°

(25) The ionizing energy and the ionizing potential for a hydrogen atom are ....and ....respectively.

knowing that the atoms is in the ground state and energy levels are

Given by: $E_n = \frac{-13.6}{n^2}$ e.V & e =1.6× 10^{-19}C.

a) 5.5,4.5 b) 13.6, 0 c) 0,13.6 d) 13.6,13.6

The correct answer is 13.6,13.6

Because, Ionizing energy $\Delta E = E_\infty - E_1$ = 0 – (-13.6) = 13.6 eV

Ionizing potential ΔE = eV ➡ 13.6 x 1.6 x 10^{-19} = 1.6 x 10^{-19} x V ➡ V = 13.6V

Competition

Choose the correct answer:

1) Fraunhofer lines are:
   i. Continuous spectrum
   ii. Emission spectrum
   iii. Line emission spectrum
   iv. Line absorption spectrum

2) Photographing bones by X-rays is based on:
   i. X-rays are not affected by electric or magnetic fields
   ii. Its velocity in space equal to velocity of light
   iii. Reflects on smooth polished surfaces.
   iv. X-rays have high penetrating power

3) X-rays have following properties except:
   i. it is electromagnetic waves
   ii. has the same speed as light in s[pace
   iii. has low frequency
   iv. is not affected by electric or magnetic fields