# Sharath Gore

**Physics NEET mock test 4 2022-23**

| Time : 75 Min | Phy : Full Portion Paper | Marks : 200 |
|---|---|---|

**Hints and Solutions**

**01)** Ans: **D)** 6.2 eV

Sol: $K_{max}\,(eV) = 12375\left[\frac{1}{\lambda\,(Å)} - \frac{1}{\lambda_0(Å)}\right]$

$\Rightarrow K_{max} = 12375\left[\frac{1}{1000} - \frac{1}{2000}\right] = 6.2\ eV$

**02)** Ans: **D)** The Statement 1 is false but the Statement 2 is true

Sol: Since, X-rays are electromagnetic waves, we know that electromagnetic wave travels with same velocity of light in vacuum.

Now, from the formula $E = \frac{hc}{\lambda}$ ...(1)

The wavelength of X-rays are small than light waves and energy is inversely proportional to the wavelength. Hence, the energy of X-rays photon will be greater than light waves.

**03)** Ans: **D)** $\frac{v_0^2}{2\mu g}$

Sol: Here, Retarding force $F = ma = \mu R = \mu mg$

$\therefore a = \mu g$

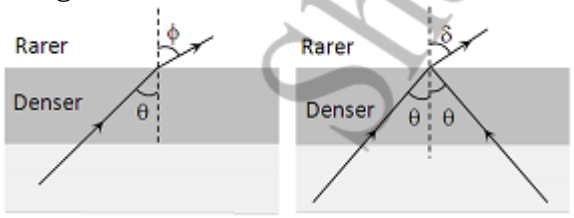
Now from equation of motion, $v^2 = u^2 - 2as$

$\Rightarrow 0 = u^2 - 2as \Rightarrow s = \frac{u^2}{2a} = \frac{u^2}{2\mu g} = \frac{v_0^2}{2\mu g}$

**04)** Ans: **B)** $\pi - 2C$

Sol: As the ray passes through the rarer medium, the deviation is $\delta = \phi - 0$. This can have a maximum value of $\left(\frac{\pi}{2} - C\right)$ for $\theta = C$ and $\phi = \frac{\pi}{2}$.

When total internal reflection occurs, at that time the deviation is $\delta = \pi - 2$, the minimum value of $\theta$ being C. The maximum value of $\delta = \pi - 2C$.




**05)** Ans: **B)** increase.

Sol: Since $h \propto \frac{1}{r}$, $\therefore$ r h = constant.

**06)** Ans: **A)** $2\pi e^2 / hc$

Sol: The speed of electron in $n^{th}$ orbit (in CGS),

$v_n = \frac{2\pi Ze^2}{nh}$ (k = 1)

For first orbit $H_2$, n = 1 and Z = 1

$\therefore v = \frac{2\pi e^2}{h} \Rightarrow \frac{v}{c} = \frac{2\pi e^2}{hc}$

**07)** Ans: **A)** 10

Sol: Given, $V_L = 46$ volts, $V_C = 40$ volts, $V_R = 8$ volts

Thus, the e. m. f. of source is given by

$V = \sqrt{8^2 + (46-40)^2} = 10$ volts

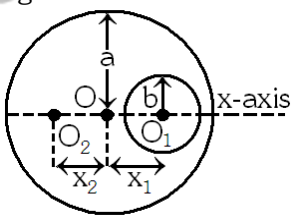
**08)** Ans: **A)** 1 m

Sol: We know, $\beta = \frac{\lambda D}{d}$

$\Rightarrow (4\times10^{-3}) = \frac{4\times10^{-7}\times D}{0.1\times10^{-3}} \Rightarrow D = 1\ m$

**09)** Ans: **A)** 0.4 cm

Sol: As per given in the problem, consider radius of complete disc is a and that of small disc is b. Also suppose that centre of mass now shifts to $O_2$ at a distance $x_2$ from original centre as shown in the figure.




Now here the position of new centre of mass is given by, $X_{CM} = \frac{-\sigma\,\pi b^2.x_1}{\sigma.\pi a^2 - \sigma.\pi b^2}$

Given that, a = 6 cm, b = 2 cm, $x_1$= 3.2 cm

$\therefore X_{CM} = \frac{-\sigma\times\pi(2)^2\times3.2}{\sigma\times\pi\times(6)^2 - \sigma\times\pi\times(2)^2} = \frac{12.8\pi}{32\pi} = -0.4$ cm

**10)** Ans: **A)** inertia forces to viscous force.

**11)** Ans: **A)** $\frac{5}{7}$

Sol: The fraction of supplied energy which increases the internal energy is given by

$f = \frac{\Delta U}{(\Delta Q)_P} = \frac{(\Delta Q)_V}{(\Delta Q)_P} = \frac{\mu C_V \Delta T}{\mu C_P \Delta T} = \frac{1}{\gamma}$

For diatomic gas, $\gamma = \frac{7}{5} \Rightarrow f = \frac{5}{7}$.

**12)** Ans: **A)** $2.4\pi\times10^{-4}\ T\,m\,A^{-1}$

Sol: Given, $X_m = 599$

Relative permeability of the material, $\mu_r = 1 + X_m$

or $\mu_r = 1 + 599 = 600$

$\therefore \mu = \mu_r \mu_0 = 600 \times \left(4\pi \times 10^{-7}\right) = 24\pi \times 10^{-5}\,\mathrm{T\,m\,A^{-1}}$

**13)** Ans: **A)** zero.

Sol: The circular loop behaves as a magnetic dipole whose one surface will be N-pole and another will be S-pole. Thus, magnetic lines a force emerges from N will meet at S. Therefore total magnetic flux through x-y plane is zero.

**14)** Ans: **A)** Both Statement 1 and Statement 2 are true but Statement 2 is not the correct explanation of Statement 1

Sol: To start a car, a very high current is required. A car battery has very low internal resistance, so it can provide the required high current. When eight dry cells are joined in series, the internal resistance of the combination becomes very high. Due to this high internal resistance, small current will be drawn from it.

Hence, such cells cannot be used to start a car. On a warm day, the internal resistance of car battery decreases and so large current can be drawn from the battery. But on a chilly day, the reverse process occurs.

**15)** Ans: **C)** The Statement 1 is true, but the Statement 2 is false

Sol: The physical quantities which do not depend on the other quantities are called fundamental quantities. Also, length, mass and time are not the derived quantities. These are fundamental quantities.

**16)** Ans: **B)** 3%

Sol: $V = \frac{4}{3}\pi r^3$

$\therefore$ % error is volume $= 3 \times$ % error in radius

$= 3 \times 1$ = 3%

**17)** Ans: **D)** 0.64 A

Sol: Conductivity, $\sigma = ne(\mu_e + \mu_h)$

$\Rightarrow \sigma = 2 \times 10^{19} \times 1.6 \times 10^{-19}(0.36 + 0.14) = 1.6\,(\Omega\text{-m})^{-1}$

Resistance, $R = \rho\frac{1}{A} = \frac{1}{\sigma A} = \frac{0.5 \times 10^{-3}}{1.6 \times 10^{-4}} = \frac{25}{8}\Omega$

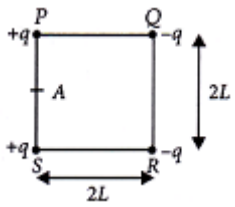
$\therefore$ Current, $i = \frac{V}{R} = \frac{2}{25/8} = \frac{16}{25}\,A = 0.64\,A$

**18)** Ans: **B)** 9975

Sol: Resistance,

$R = \frac{V}{i_g} - G \Rightarrow R = \frac{100}{10 \times 10^{-3}} - 25 = 9975\,\Omega$

**19)** Ans: **C)** $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1 - \frac{1}{\sqrt{5}}\right)$




Sol:

A is the midpoint of PS

$\therefore PA = AS = L$

$AR = AQ = \sqrt{(SR)^2 + (AS)^2}$

$= \sqrt{(2L)^2 + (L)^2} = L\sqrt{5}$

Electric potential at point A due to the given charge configuration is

$V_A = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{PA} + \frac{q}{AS} + \frac{(-q)}{AQ} + \frac{(-q)}{AR}\right]$

$= \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{L} + \frac{q}{L} - \frac{q}{L\sqrt{5}} - \frac{q}{L\sqrt{5}}\right]$

$= \frac{1}{4\pi\varepsilon_0}\left[\frac{2q}{L} - \frac{2q}{L\sqrt{5}}\right] = \frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left[1 - \frac{1}{\sqrt{5}}\right]$

**20)** Ans: **B)** $T \propto R^2$

Sol: Here the required centripetal force is provided by the gravitational force.

$\therefore m\omega^2 R = \frac{GMm}{R^3} \Rightarrow \frac{4\pi^2}{T^2} = \frac{GM}{R^4} \Rightarrow T \propto R^2$

**21)** Ans: **A)** X-rays

Sol: Here E=13.2 keV

$\lambda\left(\text{in } \mathring{A}\right) = \frac{hc}{E(eV)} = \frac{12400}{13.2 \times 10^3} = 0.939\,\mathring{A} \approx 1\,\mathring{A}.$

X-rays covers wavelengths ranging from about $10^{-8}$ m (10 nm) to $10^{-13}$ m $\left(10^{-4}\text{ nm}\right)$.

An electromagnetic radiation of energy 13.2 keV belongs to X-ray region of electromagnetic spectrum.

**22)** Ans: **A)** Both statement 1 and statement 2 are true and the statement 2 is the correct explanation of the statement 1.

**23)** Ans: **C)** The Statement 1 is true, but the Statement 2 is false

Sol: From the reaction hydrogen is converted into helium, with the nucleus releasing two positrons and energy. Because of positron emission it cannot be $\beta$-decay. The energy emitted and participation of light of nuclei correspond to the fusion reaction.

**24)** Ans: **C)** inversely proportional to square root of molecular weight.

Sol: We know, $v_{rms} = \sqrt{\frac{3RT}{M}} \Rightarrow v_{rms} \propto \frac{1}{\sqrt{M}}$

**25)** Ans: **C)** Statement 1 is true but statement 2 is false.

Sol: Very large aperture gives blurred images due to aberrations. By reducing the aperture, the clear

image is obtained and thus the sensitivity of camera increases. Also, the focusing of object at different distance is achieved by slightly altering the separation of the lens from the film.

**26)** Ans: **A)** 1

Sol: By using, acceleration $A = -\omega^2 x$

At $-x_{max}$, A will be maximum and positive.

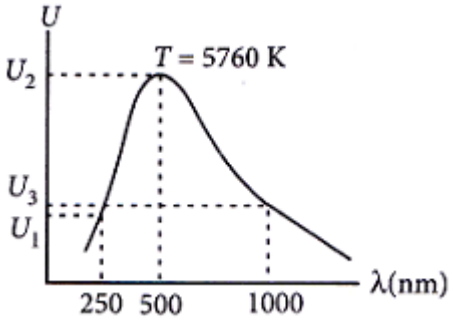
**27)** Ans: **C)** first increases then decreases to zero.

Sol: For jumping, the man presses the spring platform, therefore the reading of spring balance increases first and finally it becomes zero.

**28)** Ans: **B)** $U_2 > U_1$

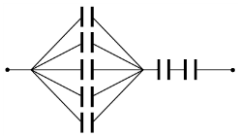
Sol: According to Wein's displacement law

$$\lambda_m = \frac{b}{T} = \frac{2.88\times10^6\,\text{nm K}}{5760\,\text{K}} = 500\,\text{nm}$$




Clearly from graph $U_2 > U_3$ and $U_2 > U_1$

**29)** Ans: **D)**



**30)** Ans: **C)** Statement 1 is true but statement 2 is false.

Sol: We know that the 98.4°F is the standard body temperature of a man. If a man touch a iron or wooden ball at 98.4° F, no heat transfer takes place between ball and man, therefore both the balls would feel equally hot for the man.

**31)** Ans: **C)** both energy and momentum are conserved.

**32)** Ans: **A)** Both statement 1 and statement 2 are true and the statement 2 is the correct explanation of the statement 1.

Sol: As X-rays lie in electromagnetic spectrum.

**33)** Ans: **B)** $5\times10^{14}$

Sol: Energy released in the fission of one nucleus =200 MeV

$$= 200\times10^6\times1.6\times10^{-19}\ \text{J} = 3.2\times10^{-11}\text{J}$$

Given, $P = 16\,\text{KW} = 16\times10^3\,\text{Watt}$

Now, number of nuclei required per second is

$$n = \frac{P}{E} = \frac{16\times10^3}{3.2\times10^{-11}} \Rightarrow n = 5\times10^{14}$$

**34)** Ans: **C)** $12\times10^{-3}$ N m

Sol: Here, maximum torque = p E

= 2 x $10^{-6}$ x 3 x $10^{-2}$ x 2 x $10^5$

$\Rightarrow$ Maximum torque = 12 x $10^{-3}$ N-m.

**35)** Ans: **D)** 25 kg

Sol: Here, the frequency of vibration of a string

$$n = \frac{p}{2l}\sqrt{\frac{T}{m}}$$

Also number of loops = Number of antinodes.

Therefore, with 5 antinodes and hanging mass of 9 kg.

We have p = 5 and T = 9 g $\Rightarrow n_1 = \frac{5}{2l}\sqrt{\frac{9g}{m}}$

With 3 antinodes and hanging mass M

We have p = 3 and T = M g $\Rightarrow n_2 = \frac{3}{2l}\sqrt{\frac{Mg}{m}}$

As $n_1 = n_2 \Rightarrow \frac{5}{2l}\sqrt{\frac{9g}{m}} = \frac{3}{2l}\sqrt{\frac{Mg}{m}} \Rightarrow M = 25$ kg.

**36)** Ans: **D)** This Statement 1 is false but the Statement 2 is true

Sol: A charged body and a uncharged body can attract each other. When such bodies are placed near each other, the induced charges of opposite kind are produced on the uncharged body.

**37)** Ans: **C)** $300\,(4)^{-0.4/1.4}$

Sol: As for adiabatic process, $\frac{T^\gamma}{P^{\gamma-1}} =$ constant

$$\therefore \frac{T_2}{T_1} = \left(\frac{P_1}{P_2}\right)^{\frac{1-\gamma}{\gamma}} \Rightarrow \frac{T_2}{300} = \left(\frac{4}{1}\right)^{\frac{(1-1.4)}{1.4}} \Rightarrow T_2 = 300(4)^{-\frac{0.4}{1.4}}$$

**38)** Ans: **B)** $8.4\times10^6$ J

Sol: Here, $T_1 = 627 + 273 = 900\,\text{K}, Q_1 = 3\times10^6$ cal

$T_2 = 27 + 273 = 300\,\text{K}$

As $\frac{Q_1}{Q_2} = \frac{T_1}{T_2} \Rightarrow Q_2 = \frac{T_2}{T_1}\times Q_1$

$$= \frac{300}{900}\times3\times10^6 = 1\times10^6\ \text{cal}$$

Work done $= Q_1 - Q_2 = 3\times10^6 - 1\times10^6 = 2\times10^6$ cal

$$= 2\times4.2\times10^6\ \text{J} = 8.4\times10^6\text{J}$$

**39)** Ans: **C)** $\frac{3GM}{a}$

Sol: Here, Mass of a particle $= M$

Mass of a spherical shell $= M$

Radius of a spherical shell $= a$

Let O be centre of a spherical shell.

Gravitational potential at point P due to particle at O is $V_1 = -\frac{GM}{\frac{a}{2}}$

Gravitational potential at point P due to spherical

shell is

$$V_2 = -\frac{GM}{a}$$

Hence, total gravitational potential at point P is

$$V = V_1 + V_2$$

$$= \frac{-GM}{\frac{a}{2}} + \left(\frac{-GM}{a}\right) = \frac{-2GM}{a} - \frac{GM}{a} = \frac{-3GM}{a}$$

$$|V| = \frac{3GM}{a}$$

**40)** Ans: **B)** decreases to a value less than $\omega$.
Sol: Melting of ice produces water which will spread over larger distance away from the axis of rotation. This increases the moment of inertia therefore angular velocity decreases.

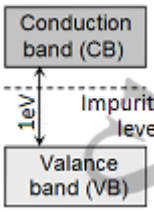
**41)** Ans: **B)** Both statement 1 and statement 2 are true but statement 2 is not the correct explanation of the statement 1.
Sol: For this, example can be given as, consider an equation $\vec{F} = m\vec{a}$ mass is a scalar quantity, but acceleration is a vector quantity.

**42)** Ans: **C)** $4\,\Omega$

Sol: We know, $\text{Resistance} = \frac{\text{Potential difference}}{\text{Current}}$.

**43)** Ans: **B)** Both statement 1 and statement 2 are true but statement 2 is not the correct explanation of the statement 1.
Sol: At constant temperature, PV =constant for an ideal gas and $\overline{v^2} = v_{rms}^2 = \frac{3kT}{m} \Rightarrow \overline{v^2} \propto \frac{1}{m}$.

**44)** Ans: **C)** The Statement 1 is true, but the Statement 2 is false
Sol: Only static friction is a self adjusting force. This is because force of static friction is equal and opposite to applied force (so long as actual motion does not start).




**45)** Ans: **A)**
Sol: Impurity energy level lies just below the conduction band in N-type semiconductor.

**46)** Ans: **A)** $90^o$
Sol: As, Tension at mean position,

$$mg + \frac{mv^2}{r} = 3mg \qquad \Rightarrow v = \sqrt{2gl} \quad \ldots(i)$$

and if the body displaces by angle $\theta$ with the vertical, then $v = \sqrt{2gl(1-\cos\theta)}$ …(ii)

By (i) and (ii), $\cos\theta = 0 \Rightarrow \theta = 90^\circ$

**47)** Ans: **A)** Both statement 1 and statement 2 are true and the statement 2 is the correct explanation of the statement 1.
Sol: Einstein equation is $E = mc^2$. Therefore it may be observed that if mass is conserved then only energy is conserved and vice-versa. Thus, both cannot be treated separately.

**48)** Ans: **D)** 8 m
Sol: As we know, $S \propto u^2$

$$\therefore \frac{S_1}{S_2} = \left(\frac{u_1}{u_2}\right)^2 \Rightarrow \frac{2}{S_2} = \frac{1}{4} \Rightarrow S_2 = 8\text{ m}$$

**49)** Ans: **A)** Both statement 1 and statement 2 are true and the statement 2 is the correct explanation of the statement 1.
Sol: A compression is a region of medium in which particles come closer means distance between the particles becomes less than the normal distance between them. Therefore there is a temporary decrease in volume and a consequent increase in density of medium. Similarly in rarefaction, particle get farther apart and a consequent decrease in density.

**50)** Ans: **B)** to the left
Sol: Parallel currents attract and antiparallel currents repel. Because of both 20 A(P) as well as 60 A (R), the force on Q is towards left.