Solution

NEET PHYSICS SAMPLE PAPER 11TH SYLLABUS - 02

NEET-UG - Physics

PHYSICS (Section-A)

1.

(d) $[ML^{-1}T^{0}]$

Explanation: We know,

dimension of F = $[MLT^{-2}]$

dimension of v = $[LT^{-1}]$

$\therefore$ dimension of F = dimension of K $\times$ dimension of v^2

$\Rightarrow$ $[MLT^{-2}]$ = dimension of K $\times$ $[LT^{-1}]^2$

dimension of K = $\frac{[MLT^{-2}]}{[ML^2T^{-2}]}$ = $[ML^{-1}]$

2.

(d) $\frac{coulomb^2}{(newton\ metre^2)}$

Explanation: The unit of permittivity of free space is,

$\mathrm{F}=\frac{1}{4\pi\varepsilon_{\mathrm{p}}}\frac{\mathrm{Q}_1Q_2}{r^2}$

$\varepsilon_0 \propto \frac{Q^2}{F\times r^2}$

So, ε_0 has units of $\frac{coulomb^2}{(newton\ metre^2)}$

3.

(d)

Explanation:

4.

(d) y = 2x - $5x^2$

Explanation: $\tan\theta=\frac{u\sin\theta}{u\cos\theta}=\frac{2}{1}$

The desired equation is,

$y=x\tan\theta-\frac{gx^2}{2u^2\cos^2\theta}$

$=x\times 2-\frac{10x^2}{2(\sqrt{2^2+1^2})^2\left(\frac{1}{\sqrt{5}}\right)^2}$

or y = 2x - $5x^2$

5.

(c) 30^{o}

Explanation: $v^2 = u^2 - 2gh$

or $u^2 = v^2 + 2gh$

or $u_x^2 + u_y^2 = v_x^2 + v_y^2 + 2gh$

As $v_x = u_x$

$\therefore u_y^2 = v_y^2 + 2gh$

or $u_y^2 = (2)^2 + 2 \times 10 \times 0.4 = 12$

$\therefore u_y = \sqrt{12} = 2\sqrt{3}\mathrm{m/s}$

and $u_x = v_x = 6$ m/s

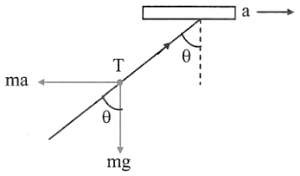
$\therefore \tan\theta = \frac{u_y}{u_x} = \frac{2\sqrt{3}}{6} = \frac{1}{\sqrt{3}}$

$\therefore \theta = 30^\circ$

6. **(a)** to the left and angle of inclination of the pendulum with the vertical is $\tan^{-1}\left(\frac{a}{g}\right)$

Explanation:

When the truck moves towards the right with acceleration 'a', then due to pseudo force, the pendulum will tilt in the backward direction (to the left) making an angle θ with the vertical



From figure,

T sin θ = ma

T cos θ = mg

$\therefore$ tan $\theta = \frac{a}{g}$

$\therefore \theta$ $\tan^{-1}\left(\frac{a}{g}\right)$

7.

(b) 600 J

Explanation: M = 5 kg, h = 20 m

Since, the water leaks at a constant rate of 0.2 kg/m, suppose x be the distance pulled up, then the reduced mass, m = 0.2 x.

$\therefore$ Effective mass = (M - m) = (5 - 0.2 x)

$\therefore$ Total work done,

W = $\int_{x=0}^{x=20} F \cdot dx = \int_{x=0}^{x=20} (M-m) g dx$

= $\int_{x=0}^{x=20} (5 - 0.2x) \times 10 \times dx$

= $\left[50x - 2\frac{x^2}{2}\right]_0^{20}$

= 1000 - 400 = 600 J

8.

(d) $\vec{V} = -\frac{m}{M}\vec{v}$

Explanation: According to the law of conservation of linear momentum, if no external force acts on a system (i.e., the system is isolated) of constant mass (i.e., the system is closed) the total momentum of the system remains constant with time. In the present problem, the bullet and rifle form a system and the force exerted by the trigger will be internal.

Hence, $\overrightarrow{p_S} = \overrightarrow{p_B} + \overrightarrow{p_R}$ = constant.

Now, as initially both the bullet and rifle are at rest, hence;

$\overrightarrow{p_B} + \overrightarrow{p_R}$ = 0

[Note: $\overrightarrow{p_R} = -\overrightarrow{p_B}$, if bullet acquires forward momentum, the rifle will acquire equal and opposite (backward) momentum.]

As $\vec{p} = m\vec{v}$, hence $m\vec{v} + M\vec{v}$ = 0

i.e., $\vec{V} = -\frac{m}{M}\vec{v}$

9. **(a)** Angular momentum

Explanation: In free space, there will be no torque acting on the sphere. Therefore, the angular momentum of the sphere will not be affected.

$\tau = \frac{dL}{dt} = 0$
i.e., L = constant

10.

(c) $\frac{I_1\omega_1}{I_2+I_1}$
Explanation: $\frac{I_1\omega_1}{I_2+I_1}$

11.

(b) S_1 and S_2 are moving with the same speed.
Explanation: The satellite of mass m is moving in a circular orbit of radius r.
$\therefore$ Kinetic energy of a satellite, K = $\frac{GMm}{2r}$ ...(i)
Potential energy of a satellite, U = $\frac{-GMm}{2r}$ ...(ii)
Orbital speed of a satellite, v = $\sqrt{\frac{GM}{r}}$ ...(iii)
Time-period of a satellite, T = $\left[\left(\frac{4\pi^2}{GM}\right)r^3\right]^{1/2}$ ...(iv)
Given: $m_{s_1} = 4m_{s_2}$
Since, M, r is same for both the satellites S_1 and S_2
$\therefore$ From equation (ii), we get;U $\propto$ m
$\therefore \quad \frac{U_{S_1}}{U_{S_2}} = \frac{m_{S_1}}{m_{S_2}}$ = 4 or $U_{S_1} = 4U_{S_2}$
Hence, this is wrong.
From eqn. (iii), since v is independent of the mass of a satellite, the
orbital speed is same for both the satellites S_1 and S_2
Hence, this is correct.
From eqn. (i), we get; K $\propto$ m
$\therefore \quad \frac{K_{S_1}}{K_{S_2}} = \frac{m_{S_1}}{m_{S_2}}$ = 4
or $K_{S_1} = 4K_{S_2}$
Hence, this is wrong,
From eqn. (iv), since T is independent of the mass of a satellite, the
time period is same for both satellites S_1 and S_2

12.

(b) Fall
Explanation: The level of water will rise when stones are unloaded into water. The density of stones is more than the density of water. So, when the stones are dropped into the water, the stone replaces the volume of water equal to the volume of stones.

13. **(a)** $\lambda_m \propto T^{-1}$
Explanation: By using Wien's displacement law,
$\lambda_{\max} \times$ T = constant
$\Rightarrow \lambda \propto T^{-1}$

14.

(c) 40g
Explanation: Let m gram of ice is added.
From principal of calorimeter
heat gained (by ice) = heat lost (by water)
$\therefore$ 20 $\times$ 2.1 $\times$ m + (m - 20) $\times$ 334 = 50 $\times$ 4.2 $\times$ 40
376 m = 8400 + 6680
m = 40.1

15.

(b) from outside atmosphere to gas
Explanation: from outside atmosphere to gas

16.

(d) 1

Explanation: Energy per gram is only a function of Temperature and is intensive in nature, Hence it would be same for both O_2 and H_2.

17. **(a)** $\frac{10}{\pi}$ HZ, 5 cm

Explanation: $\frac{10}{\pi}$ HZ, 5 cm

18.

(c) only ii

Explanation: As y = A_b sin($2\pi n_{av}$t)

where A_b = 2A cos($2\pi n_A$t) It where $n_A = \frac{n_1 - n_2}{2}$

19.

(c) A-(ii), B-(iii), C-(i)

Explanation: Whenever two waves having the same frequency travel with the same speed along the same direction in a specific medium, then they superpose and create an effect termed as the interference of waves.

Where two waves having similar frequencies move with the same speed along with opposite directions in a specific medium, then they superpose to produce stationary waves.

When two waves having slightly varying frequencies travel with the same speed along the same direction in a specific medium, they superpose to produce beats.

20.

(c) $\left[\frac{r - t + t\sqrt{K}}{r}\right]^2$

Explanation: In air; $F_1 = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$

In dielectric; $F_K = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{Kr^2}$

For the same force in air and dielectric, if r is the distance between charges in air and d is dielectric medium, then

$Kd^2 = r^2$ or $r = d\sqrt{K}$

Hence, the equivalent separation in air (after the dielectric has been introduced) is given by:

$r - t + t\sqrt{K} = r'$ (say)

Here, r' > r, since K > 1

Thus, the force between the charges with the dielectric is given by:

$F_2 = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{(r - t + t\sqrt{K})^2}$

$\therefore \frac{F_1}{F_2}$,= $\left[\frac{r - t + t\sqrt{K}}{r}\right]^2$

21.

(c) 2 : 3

Explanation: Between the points P and g, a capacitor C_1 and a series combination of C_2, C_3, C_4, C_5 are connected in parallel.

$\therefore \quad \frac{1}{C_s} = \frac{1}{C_2} + \frac{1}{C_3} + \frac{1}{C_4} + \frac{1}{C_5}$

$= \frac{1}{C} + \frac{1}{C} + \frac{1}{C} + \frac{1}{C} = \frac{4}{C}$

or C_s = C/4

The equivalent capacitance between P and Q is:

C' = $C_1 + C_s$

= C + C/4 = 5C/4

Between the point P and R, a series combination of C_1, C_2 and a series combination of C_3, C_4, C_5 are connected in parallel.

$\therefore \quad \frac{1}{C_s'} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{C} + \frac{1}{C} = \frac{2}{C}$

or C'_s = C/2

and $\frac{1}{C_s''} = \frac{1}{C_3} + \frac{1}{C_4} + \frac{1}{C_5} = \frac{1}{C} + \frac{1}{C} + \frac{1}{C} = \frac{3}{C}$

or C'_s = C/3

The equivalent capacitance between P and R is:

$C'' = C_s' + C_s'' = \frac{C}{2} + \frac{C}{3} = \frac{5C}{6}$

$\therefore \quad \frac{C''}{C'} = \frac{5C/6}{5C/4} = \frac{2}{3}$

22. **(a)** 1.95 V
Explanation: 1.95 V
Explanation:
Given : Internal resistance of the cell (r) = 0.1 Ω; E.M.F. of the cell (E) = 2 V and external resistance (R) = 3.9 Ω.
$= E - \frac{E}{R+r} . r$
$= 2 - \frac{2}{3.9+0.1} \times 0.1$
= 1.95 V

23.
(c) contract
Explanation: Treat the gas as a thick conductor carrying a uniform current. Apply Ampere's law to .find the magnetic field. Then apply the left-hand rule to find the direction of Ampere force.

24.
(d) 3.267×10^{-4}
Explanation: According to Curie law for paramagnetic substance,
$\chi \propto \frac{1}{\mathrm{T_C}} \Rightarrow \frac{\chi_1}{\chi_2} = \frac{\mathrm{T_{C_2}}}{\mathrm{T_{C_1}}}$
$\frac{2.8\times10^{-4}}{\chi_2} = \frac{300}{350}$
$\chi_2 = \frac{2.8\times350\times10^{-4}}{300}$ = 3.266×10^{-4}

25.
(d) rise
Explanation: rise

26. **(a)** 5 mH
Explanation: We know that emf, $E = -L\frac{di}{dt}$
So, $L = \frac{-E}{\frac{di}{dt}}$
Put given values, we get
$\Rightarrow L = \frac{-5\times10^{-3}}{(2-3)} = \frac{-5\times10^{-3}}{-1}$
$\Rightarrow L = 5 \times 10^{-3} H = 5\ mH$

27. **(a)** Doubled
Explanation: P$= \frac{e^2}{R} = \frac{\left(-NA\frac{dB}{dt}\right)^2}{\rho l} \times A_C,$
A = area of coil
A_c = area of cross section of wire used in coil
P $\propto$ NA_c
$\frac{P_2}{P_1} = \frac{\frac{N}{2}\times4A_c}{NA_c}$ = 2; $P_2 = 2P_1$

28.
(b) 50 ampere per sec
Explanation: 50 ampere per sec

29. **(a)** velocity
Explanation: As we know that,
When traveling in a vacuum, electronic waves from the electromagnetic spectrum travel at the same speed. Velocity is the speed with direction, so they all travel at the same velocity, relatively speaking. But frequency and wavelength are quite different. The thing that makes the waves different is their respective wavelengths, which in turn determines their respective frequencies.

30.
(c) Only (i), (iii) and (iv)
Explanation: Only (i), (iii) and (iv)

31.
(d) becomes narrower

Explanation: In single slit diffraction, the angular width of the diffraction pattern $\sin\theta = \frac{\lambda}{b}$
Since, the wavelength of blue light is less than that of red light, so angular width of the diffraction pattern is less when blue light is used. So the diffraction pattern becomes narrower.

32.

(d) 401 p_0

Explanation: $\lambda = \frac{h}{p}$ ...(i)
$\left(\lambda + \frac{0.25}{100}\lambda\right) = \frac{h}{(p-p_0)}$
or $\frac{100.25\lambda}{100} = \frac{h}{p-p_0}$ ...(ii)
From (i) and (ii),
$\therefore \frac{100.25}{100} = \frac{p}{p-p_0}$
on solving, p = 401 p_0

33. **(a)** 4λ

Explanation: $eV = hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$ ...(i)
$\frac{eV}{3} = hc\left(\frac{1}{2\lambda} - \frac{1}{\lambda_0}\right)$ ...(ii)
Dividing eqn. (i) by (ii), we get;
$3 = \frac{\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)}{\left(\frac{1}{2\lambda} - \frac{1}{\lambda_0}\right)}$
or $3\left(\frac{1}{2\lambda} - \frac{1}{\lambda_0}\right) = \frac{1}{\lambda} - \frac{1}{\lambda_0}$
or $\frac{3}{2\lambda} - \frac{1}{\lambda} = \frac{3}{\lambda_0} - \frac{1}{\lambda_0} = \frac{2}{\lambda_0}$
or $\frac{1}{2\lambda} = \frac{2}{\lambda_0}$ or $\lambda_0 = 4\lambda$

34.

(b) $1s^2 2s^2 2p^6 3s^2 3p^2$

Explanation: We know that s orbital contains maximum 2 electrons and p contains a maximum 6 electrons. s-orbitals filled by electron first then p-orbitals.

35. **(a)** n + p $\rightarrow$ d + γ

Explanation: For momentum and energy conservation, mass defect (Δm) should be positive. Since some energy is lost in every process.
$(m_p + m_n) > m_d$

PHYSICS (Section-B)

36.

(c) 6.55 m/s

Explanation: Given: h = 12.4, v =?

$\therefore v^2 = u^2 + 2gh$

i.e. $v^2 = u^2 + 2 \times 9.8 \times 12.4$

$= u^2 + 243.04$

Kinetic energy of the ball when it just hits the wall
$= \frac{1}{2}mv^2 = \frac{1}{2}m\left(u^2 + 243.04\right)$
The KE of ball after the impact
$= \frac{(100-15)}{100} \times \frac{1}{2}m\left(u^2 + 243.04\right)$
$= \frac{85}{100} \times \frac{1}{2}m\left(u^2 + 243.04\right)$
Let v_2 be the upward velocity just after the collision with the ground.
So, $\frac{1}{2}mv_2^2 = \frac{85}{100} \times \frac{1}{2}m\left(u^2 + 243.04\right)$
$v_2^2 = \frac{85}{100}\left(u^2 + 243.04\right)$
Now, taking upward motion
v = 0, u = v_2

$\therefore v^2 = u^2 - 2gh$

$= \frac{85}{100}\left(u^2 + 243.04\right)$ - 2 × 9.8 × 12.4

or $\frac{85}{100}u^2$ = 36.46 or u^2 = 12.89

∴ u = 6.55 m/s

37.

(d) $\rho_2 : \rho_1$

Explanation: $M = \pi R^2 \rho$, M and t same $R^2\rho$ = constant or $R^2 \propto \frac{1}{\rho}$

Again $I = l\frac{1}{2}MR^2$ or $I \propto R^2$ or $l \propto \frac{1}{\rho}$ or $I \propto \frac{1}{\rho}$

$\therefore \frac{I_1}{I_2} = \frac{\rho_2}{\rho_1}$

38.

(d) $W_1 < W_2 > W_3$

Explanation: Because the value of g decreases when we move either in a coal mine or at the top of the mountain.

39. **(a)** $K_1K_4 = K_2K_3$

Explanation: $K_1K_4 = K_2K_3$

40.

(b) 612 m/s

Explanation: As we know that,

If, ρ_{mix} = 1

then, $\rho_{\text{mix}} = \frac{4 \times 1 + 1 \times 16}{(4+1)}$ = 4

$\frac{v_{\text{mix}}}{v_H} = \sqrt{\frac{\rho_H}{\rho_{mix}}}$

$= \sqrt{\frac{1}{4}} = \frac{1}{2}$

$v_{\text{mix}} = \frac{v_H}{2}$

$= \frac{1224}{2}$ = 612 m/s

41.

(d) The sound waves in air are longitudinal while the light waves are transverse.

Explanation: Light waves are electromagnetic waves. Light waves are transverse in nature and do not require a medium to travel. Hence, they can travel in vacuum. Sound waves are longitudinal waves and require a medium to travel. They do not travel in vacuum.

42. **(a)** 2.5×10^{-5} T

Explanation: $B = \frac{\mu}{2\pi}\frac{ir}{R^2} = 2 \times 10^{-7} \times 10 \times \frac{2\times10^{-2}}{(4\times10-2)^2}$

$= 2.5 \times 10^{-5}$ T

43.

(c) $2\pi \times 10^{-7}$ Nm

Explanation: Torque acting on magnet,

τ = MB sin θ

= mlBsinθ

$= 2\pi \times 10^{-7}$ Nm

44.

(d) only ii

Explanation: When the magnet is rotated about its axis, the lines of force remain the same and the flux through the coil doesn't change. Thus, there is no current induced in the coil.

45.

(c) 13.89 H

Explanation: Energy stored in the inductor

$U = \frac{1}{2}LI^2$

$25 \times 10^{-3} = \frac{1}{2} \times L \times \left(60 \times 10^{-3}\right)^2$

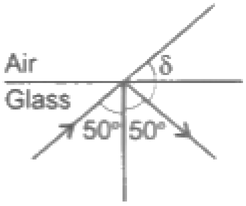
$L = \frac{25\times2\times10^6\times10^{-3}}{3600}$

$= \frac{500}{36}$H

= 13.89 H

46. **(a)** 80°

Explanation:



${}^{a}\mu_g$ = 1.5

∴ 1.5 = cosec C

or C = 42°

Critical angle for glass = 42°

Hence, a ray of light incident at 50° in glass medium undergoes total internal reflection. δ denotes the deviation of the ray.

∴ δ = 180° - (50° + 50°)

or δ = 80°

47.

(d) $\sqrt{2}$

Explanation: The angle of incidence is C = 45°.

$\therefore \mu = \frac{1}{\sin C} = \frac{1}{\sin 45^\circ} = \sqrt{2}$

48.

(d) 4.3 × 10^{17} Hz

Explanation: Given that the electrons enter the magnetic field normally θ = 90°

Magnetic force acting on electrons will be,

F = qvB sinθ = qvB

v = $\frac{F}{\mathrm{qB}}$

Force F = 10^{-6} dyne = 10^{-11} N

v = $\frac{10^{-11}}{1.6\times10^{-19}\times2.5}$

= 2.5 × 10^7 m/s

Using Einstein's photoelectric equation, we know,

K.E_{max} = h$(\nu - \nu_0)$

$\frac{1}{2}mv_{\max^2}$ = h$(\nu - \nu_0)$

$\frac{1}{2} \times 9.1 \times 10^{-31} \times \left(2.5 \times 10^7\right)^2$ = h$(\nu - \nu_0)$

2.84 × 10^{-16} = h$(\nu - \nu_0)$

$(\nu - \nu_0)$ = $\frac{2.84\times10^{-16}}{6.63\times10^{-34}}$

= 4.28 × 10^{-17}

ν = 4.29 × 10^{-17} + 10^{15}

= 4.29 × 10^{17}

$\nu \approx$ 4.3 × 10^{17} Hz

49.

(d) 2

Explanation: The first line of Lyman series of the hydrogen atom, $\frac{1}{\lambda_L} = R\left[\frac{1}{1^2} - \frac{1}{2^2}\right]$

The second line of Balmer series of hydrogen-like ion, $\frac{1}{\lambda_B} = RZ^2\left[\frac{1}{2^2} - \frac{1}{4^2}\right]$

$\lambda_L = \lambda_B \Rightarrow \frac{3}{4}R = \frac{3}{16}RZ^2$

∴Z^2 = 4 or Z = 2

50. **(a)** at high temperature and high pressure

Explanation: Fusion occurs at high temperatures and high pressure when the fuel is highly dense.