**Solution**

**PHYSICS**

**NEET-UG - Physics**

**PHYSICS (Section-A)**

1.

**(b)** time period

**Explanation:**

[K] = $\left[\frac{force}{length}\right]$ = $\left[\mathrm{ML}^0\mathrm{T}^{-2}\right]$

$\therefore \left[\frac{M}{K}\right]^{\frac{1}{2}} = \left[\frac{\mathrm{ML}^0\mathrm{T}^0}{\mathrm{ML}^0\mathrm{T}^{-2}}\right]^{\frac{1}{2}}$ = [T]

2. **(a)** 6%

**Explanation:**

Here, Mass of a body, M = 5.00 $\pm$ 0.05 kg

Volume of a body, F = 1.00 $\pm$ 0.05 $m^3$

Density, $\rho = \frac{M}{V}$

Relative error in density is,

$\frac{\Delta\rho}{\rho} = \frac{\Delta M}{M} + \frac{\Delta V}{V}$

Percentage error in density is,

$\frac{\Delta p}{\rho} \times 100 = \frac{\Delta M}{M} \times 100 + \frac{\Delta V}{V} \times 100$

= $\left(\frac{0.05}{5} \times 100\right) + \left(\frac{0.05}{1} \times 100\right)$

= 1% + 5% = 6%

3.

**(d)** 60

**Explanation:**

Given that maximum height = 5 m, g = 10 $ms^{-2}$

Now, $v^2 = u^2 - 2gs$

or 0 = $u^2$ - 2 $\times$ 10 $\times$ 5 = $u^2$ - 100

$\therefore$ u = 10 m/s

Further, at maximum height, v = 0

$\therefore$ 0 = u - gt = 10 - 10 $\times$ t

or t = 1 sec

It means that each ball is thrown after 1 sec. Therefore, number of balls thrown per minute = 60

4.

**(b)** 50

**Explanation:**

Position vector of particle is given as r = $15t^2\hat{\mathbf{i}} + (4 - 20t^2)\hat{\mathbf{j}}$

Velocity of particle is v = $\frac{d\mathbf{r}}{dt} = \frac{d}{dt}$ $[15t^2\hat{\mathbf{i}} + (4 - 20t^2)\hat{\mathbf{j}}]$

= $30t\,\hat{\mathbf{i}} - 40t\,\hat{\mathbf{j}}$

Acceleration of particle is $a = \frac{d}{dt}(\mathbf{v}) = \frac{d}{dt}(30t\hat{\mathbf{i}} - 40\hat{\mathbf{j}}) = 30\hat{\mathbf{i}} - 40\hat{\mathbf{j}}$

So, magnitude of acceleration at t = 1s is

$|\mathbf{a}|_{t=1s} = \sqrt{a_x^2 + a_y^2} = \sqrt{30^2 + 40^2}$

= 50 $ms^{-2}$

5.

**(c)** $\frac{a^2}{2a}$

**Explanation:**

y = ax - bx$^2$

For maximum y,

$\frac{dy}{dx} = 0$ and $\frac{d^2y}{dx^2} < 0$

$\frac{dy}{dx}$ = a - 2bx = 0

or x = $\frac{a}{2b}$

$\frac{d^2y}{dx^2}$ = -2b < 0

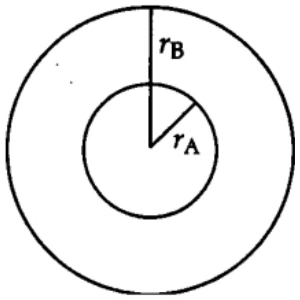
$\therefore$ For x = $\frac{a}{2b}$, y is maximum

$\therefore$ $y_{max.}$ = $a\left(\frac{a}{2b}\right) - b\left(\frac{a}{2b}\right)^2 = \frac{a^2}{4b}$

6.

**(d)** 1 : 1

**Explanation:**




Since, the time period for both the particle in same

So, $T_A = T_B = T$

Angular velocity for A, $(\omega_A)$ = $\frac{2\pi}{T_B}$

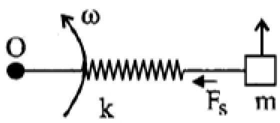
Angular velocity for B, $(\omega_B)$ = $\frac{2\pi}{T_B}$

Now, the required ratio is $\frac{\omega_A}{\omega_B} = \frac{T_B}{T_A} = \frac{T}{T} = 1$

7.

**(b)** 2 : 3

**Explanation:**




Natural length = $L_0$

Extension = x

$F_{spring} = F_{centripetal}$

$\Rightarrow kx = m(L_0 + x)\omega^2 \Rightarrow 12.5x = \frac{1}{5}(L_0 + x)25$

$\Rightarrow \quad 1.5x = L_0 \Rightarrow \frac{x}{L_0} = \frac{2}{3}$

8.

**(d)** $\frac{2}{5}$

**Explanation:**

According to principle of conservation of energy, Loss in potential energy = Gain in kinetic energy

$\Rightarrow mgh = \frac{1}{2}mv^2$

$\Rightarrow v = \sqrt{2\,gh}$

If $h_1$ and $h_2$ are initial and final heights, then

$\Rightarrow v_1 = \sqrt{2\ gh_1}$

$v_2 = \sqrt{2gh_2}$

Loss in velocity

$\Delta v = v_1 - v_2$

$= \sqrt{2\ gh_1} - \sqrt{2gh_2}$

$\therefore$ Fractional loss in velocity

$= \frac{\Delta v}{v_1}$

$= \frac{\sqrt{2gh_1} - \sqrt{2gh_2}}{\sqrt{2gh_1}}$

$= 1 - \sqrt{\frac{h_2}{h_1}}$

$= 1 - \sqrt{\frac{1.8}{5}}$

$= 1 - \sqrt{0.36}$

= 1 - 0.6

= 0.4

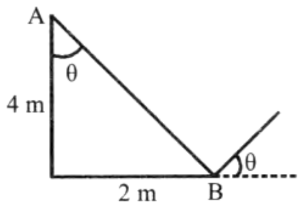
$= \frac{2}{5}$

9.

**(d)** $\tan\theta = \frac{1}{2}$

**Explanation:**

To produce maximum moment of force line of action of force must be perpendicular to line AB.




$\therefore \tan\theta = \frac{2}{4} = \frac{1}{2}$

10.

**(c)** $\frac{ML^2\omega^2}{6}$

**Explanation:**

$KE = \frac{1}{2}I\omega^2$

$= \frac{1}{2}\frac{Ml^2\omega^2}{3} = \frac{Ml^2\omega^2}{6}$

11.

**(b)** 2.5%

**Explanation:**

$\Delta g_d\% = \frac{d}{R} \times 100\%$

$= \frac{160}{6400} \times 100$

= 2.5%

12.

**(d)** Stress lags behind the strain

**Explanation:**

Stress lags behind the strain

13.

**(c)** $0.996\omega_0$

**Explanation:**

Let M be the mass of the sphere and R its radius before increasing the temperature. Then from conservation of angular momentum,

$I\omega = I_0\omega_0$

or $\omega = \frac{I_0}{I}\omega_0 = \frac{\frac{2}{5}MR^2\omega_0}{\frac{2}{5}MR^2(1+2\alpha\Delta\theta)} = \frac{\omega_0}{1+2\alpha\Delta\theta}$

$= \frac{\omega_0}{1+2\left(2.0\times10^{-5}\right)(100)} = 0.996\omega_0$

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 × 2.1 × m + (m - 20) × 334 = 50 × 4.2 × 40

376 m = 8400 + 6680

m = 40.1

15. **(a)** $5\gamma$P

**Explanation:**

For an adiabatic process, $PV^\gamma$ = constant

$\therefore \frac{P_2}{P_1} = \left(\frac{V_1}{V_2}\right)^\gamma$

$= \left(\frac{\rho_2}{\rho_1}\right)^\gamma \left(\because V = \frac{m}{\rho}\right)$

$= \left(\frac{5\rho_1}{\rho_1}\right)^\gamma (\because \rho_2 = 5\rho_1)$

$\therefore P_2 = P_1 5^\gamma$

$= 5\gamma P$ ($\because P_1 = P$)

16.

**(b)** 9R

**Explanation:**

9R

17.

**(b)** $\frac{2}{\sqrt{5}}A$

**Explanation:**

Kinetic energy $= \frac{1}{2}m\omega^2\left(A^2 - x^2\right)$

Potential energy $= \frac{1}{2}m\omega^2 x^2$

According to question, $\frac{KE}{PE} = \frac{1}{4}$

$\therefore \quad \frac{\frac{1}{2}m\omega^2\left(A^2-x^2\right)}{\frac{1}{2}m\omega^2 x^2} = \frac{1}{4}$

or $\frac{A^2-x^2}{x^2} = \frac{1}{4}$ or $4A^2 - 4x^2 = x^2$

$\therefore \quad x = \frac{2A}{\sqrt{5}}$

18.

**(b)** plucked at $\frac{L}{4}$ and touched at $\frac{L}{2}$

**Explanation:**

The plucking point of the string will be the antinode and the touching point will be node.

19.

**(d)** 415 Hz

**Explanation:**
415 Hz

20.
**(b)** $E_x = E_z < E_y$
**Explanation:**
$E_x = E_z < E_y$

21.
**(d)** 2500 volt
**Explanation:**
2500 volt

22. **(a)** potential drop inside the battery increases
**Explanation:**
Car starter takes more current, hence potential drop inside the battery increases.

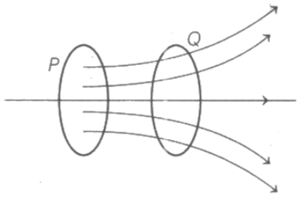
23. **(a)** $\frac{qB}{2}\left(\frac{a^2}{d}+d\right)$
**Explanation:**
The vector product between v and B points upwards in the figure thus indicating that the charge of the particle is positive.
The Force acting on the moving charge F = qvB.
As a result of the magnetic force, the charged particle will follow a spherical trajectory.
The centripetal force $F_c=\frac{mv^2}{r}$ .
Force acting on the moving charge $F = F_c$,
$qvB=\frac{mv^2}{r}$
$r=\frac{mv}{qB}=\frac{p}{qB}$ , where p is the momentum of the particle.
$r^2 = d^2 + (r - a)^2$
$=\frac{d^2+a^2}{2d}$
$=\frac{1}{2}\left(d+\frac{a^2}{d}\right)$
So, p = qBr
$=\frac{qB}{2}\left(d+\frac{a^2}{d}\right)$

24.
**(b)** 4 J
**Explanation:**
Work done in rotating dipole from angle $\theta_1$ to $\theta_2$ is given as
W = MB$(\cos\theta_1-\cos\theta_2)$
$= 5 \times 0.4 (\cos 0^o - \cos 180^o)$
$= 5 \times 0.4 \times 2 = 4$ J

25.
**(d)** Curie temperature
**Explanation:**
The temperature at which a ferromagnetic material becomes paramagnetic is called curie temperature.

26.
**(c)** $6.67 \times 10^{-4}$ Wb
**Explanation:**

As, coefficient of mutual induction is same for both coils




$\therefore\ M_{PQ} = M_{QP}$
$\Rightarrow \frac{N_P \phi_{PQ}}{I_Q} = \frac{N_Q \phi_{QP}}{I_P}$
Here, $N_P = N_Q = 1$,
$\phi_{PQ} = ?, \phi_{QP} = 10^{-3}\mathrm{Wb}$
$I_Q = 2A$, $I_P = 3$ A
Substitiuting values in Eq (i), we get
$\phi_{PQ} = \frac{I_Q \cdot \phi_{QP}}{I_P} = \frac{2}{3} \times 10^{-3}$
= $0.667 \times 10^{-3} = 6.67 \times 10^{-4}\mathrm{Wb}$

27.

**(c)** no current flows through the ammeter A.
**Explanation:**
When a cylindrical bar magnet is rotated about its axis, no change in flux linked with the circuit takes place, consequently, no emf induces, and hence, no current flows through the ammeter A. Hence the ammeter shows no deflection.

28.

**(c)** $0.6\sqrt{2}$ A
**Explanation:**
Since,
$I_{rms} = E_{rms}\ \omega C$ [$\because$ I = $\frac{V}{X_c}$]
= $200 \times 2\pi \times 50 \times 10 \times 10^{-6}$ A
$\cong$ 0.6 A
$\therefore I_0 = I_{rms} \times \sqrt{2}$
$\therefore I_0 = 0.6 \times \sqrt{2}$ A

29.

**(b)** only i
**Explanation:**
The electron will experience a Coulomb force and would start moving along the electric field. It will also experience a force due to the magnetic field that would cause instantaneous drifts along the direction of propagation even. But this force would change its direction as the direction of the electron itself changes. Overall it would be moving along the electric field.

30.

**(b)** $\mu$ = 1.50
**Explanation:**
As we know that,
For total internal reflection,
sin i > sin c
But, sin c = $\frac{1}{\mu}$
$\therefore \sin i > \frac{1}{\mu}$
or $\mu > \frac{1}{\sin i}$
$\mu > \frac{1}{\sin 45\Upsilon}$ ...($\because$ i = $45^o$)
$\therefore \mu > \sqrt{2}$

31.

**(c)** diffraction

**Explanation:**

Fact

32.

**(c)** $\frac{\lambda}{2}$

**Explanation:**

$\frac{\lambda}{2}$

33.

**(d)** all have the maximum KE equal to 1.36 eV

**Explanation:**

$V_s$ = 1.36 volt

$\therefore$ $eV_s$ = 1.36 eV

or $\frac{1}{2}$ $m(v_{max.})^2$ = 1.36 eV

i.e., various electrons have KE between zero and 1.36 eV

34.

**(d)** n$\lambda$

**Explanation:**

Circumference, $2\pi rn = n\lambda$

35.

**(d)** $10^{12}$ s

**Explanation:**

$_1H^2 + {_1H^2} \rightarrow {_1H^3} + p$

$_1H^2 + {_1H^3} \rightarrow {_2He^4} + n$

By adding given two equation $3{_1H^2} \rightarrow {_2He^4} + p + n$

$\Delta m = 3(2.014) - [4.001 + 1.007 + 1.008] = 0.026$

3 deuterons release $3.87 \times 10^{-12}$ J

$\therefore$ $10^{40}$ deuterons release = $\frac{3.87 \times 10^{-12} \times 10^{40}}{3}$

= $1.29 \times 10^{28}$ J

Power, $P = \frac{E}{t} \Rightarrow t = \frac{E}{P} = \frac{1.29 \times 10^{28}}{10^{16}}$ = $1.29 \times 10^{12}$



**PHYSICS (Section-B)**

36.

**(c)** 300 N-m

**Explanation:**

No work is done while covering the horizontal distance because

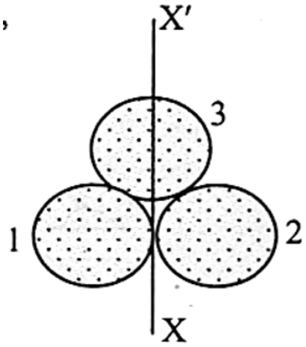
$\vec{F} \cdot \vec{s} = 0$ ($\because \theta = 90°$)

$\therefore$ Work done = Fs = $60 \times 5$ = 300 N-m

37. **(a)** $4mr^2$

**Explanation:**

Using parallel axes theorem




$I_1 = \frac{2}{3}mr^2 + mr^2$

and $I_1 = I_2$

$I_1 = \frac{2}{3}mr^2$

$\therefore$ M.I. of system about XX' is

$I = I_1 + I_2 + I_3$

$= 2\left(\frac{2}{3}mr^2 + mr^2\right) + \frac{2}{3}mr^2$

$= 4mr^2$

38. **(a)** 7.76 km $s^{-1}$

**Explanation:**

$v_0 = \sqrt{\frac{gR^2}{R+h}} = \sqrt{\frac{9.8 \times (6.3 \times 10^6)^2}{6.38 \times 10^6 + 0.25 \times 10^8}}\ ms^{-1}$

$= 6.38 \times 10^6 \sqrt{\frac{9.8}{6.63 \times 10^6}\ ms}^{-1}$

$= 7.76 \times 10^3\ ms^{-1} = 7.76\ km\ s^{-1}$

39. **(a)** 112.5 gm

**Explanation:**

112.5 gm

40. **(a)** y = a sin (at - bx + c)

**Explanation:**

The equation of wave is in the form of

y = a sin (wt - kx + c)

where c is the initial phase.

41. 

**(b)** 4.6 beats/sec

**Explanation:**

In an organ pipe the frequency of standing wave $\propto \sqrt{T}$

Thus at 27°, $v_1 - v_2 = 4$

At 127°, $v_1' - v_2' = \frac{\sqrt{T_f}}{\sqrt{T_i}}(v_1 - v_2) \approx$ 4.6 beats/sec

42. **(a)** iv

**Explanation:**

path of both particles will be equally curved

43. **(a)** $\sqrt{3}M$

**Explanation:**

$\sqrt{3}M$

44. 

**(b)** NAB$\omega$

**Explanation:**

Maximum value of emf generated in the coil is:
$e_{max.}$ = NAB$\omega$

45. **(a)** 90%
**Explanation:**
Given: Output power, P = 100 W
Voltage across primary, $V_p$ = 220 V
Current in the primary, $I_p$ = 0.5 A
Efficiency of a transformer, $\eta = \frac{\text{output power}}{\text{input power}} \times 100$
= $\frac{P}{V_p I_p} \times 100 = \frac{100}{220 \times 0.5} \times 100$ = 90%

46.
**(c)** The angular dispersion depends upon the angle of prism.
**Explanation:**
The angular dispersion depends upon the angle of prism.

47.
**(c)** 2Nv
**Explanation:**
2Nv

48.
**(c)** 650 nm
**Explanation:**
Range of work function of metals = 2 - 5 eV
$hc = 4 \times 10^{-15} \text{eVs} \times 3 \times 10^{8} \text{ms}^{-1}$ = 1200 eV-nm
As, $\lambda = \frac{hc}{E}$
$\lambda_{\min} = \frac{1200\text{eV}-\text{nm}}{5\text{eV}}$ = 240 nm
$\lambda_{\max} = \frac{1200\text{eV}-\text{nm}}{2\text{eV}}$ = 600 nm
Hence light of wavelength 650 nm cannot be used for photoelectric effect.

49. **(a)** $\frac{1}{n^3}$
**Explanation:**
$\Delta$E = hv
v = $\frac{\Delta E}{h}$ = $k\left[\frac{1}{(n-1)^2} - \frac{1}{n^2}\right]$
= $\frac{k2n}{n^2(n-1)^2} = \frac{2k}{n^3} \propto \frac{1}{n^3}$

50.
**(b)** coulomb force and gravitational force
**Explanation:**
coulomb force and gravitational force