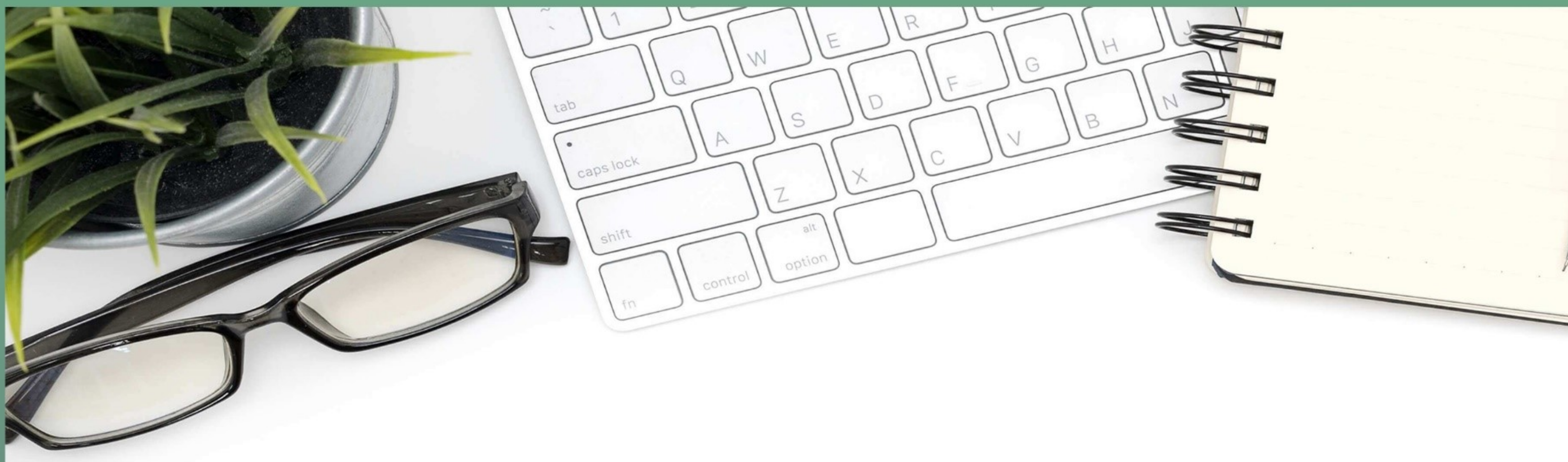

150+ Maths and Physics Questions PDF for

RRB ALP Stage II Exam Part – A

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1. In order to increase the ampere-hour of a battery, cells are connected in-
(a) Series (b) parallel
(c) series-parallel (d) star
Ans(b)
Sol. Series connections of batteries enhance the voltage capacity on the other hand parallel connection of cells increase the ampere-hour rating of a battery.
2.The capacitors are named according to
(a) dielectric material used
(b) size of capacitor
(c) materials used for the plates
(d) working voltage
Ans(a)
Sol. A dielectric material is an electrical insulator that can be polarized by an applied electric field. Capacitors are named according to the dielectric material used as paper, mica,ceramic etc.
3. The capacitance of a capacitor depends on—
(a) The dielectric material
(b) The area of plates
(c) Distance between the plates
(d) All the above
Ans(d)
Sol. Capacitance of a capacitor C = KA/d; K–dielectric constant of the material being used as a dielectric, d—distance between the plates, A—area of plates.
4. Which microphone is known as velocity operated microphone?
(a) Dynamic microphone
(b) Ribbon microphone
(c) Capacitor microphone
(d) Electret microphone
Ans(b)
Sol. Velocity ribbon microphone is a kind of pressure gradient microphone in which the
resulting force is proportional to the difference between the pressure acting on the two moving elements.
5. The magnitude of a vector is never—
(a) Zero (b) Unity
(C) Negative (d) Positive
Ans(c)
Sol, the magnitude of a vector is never be negative
6. The force of attraction or repulsion between charges follows—
(a) Square law
(b) Inverse square law
(c) Both (a) and (b)
(d) None of (a) and (b)
Ans(c)
Sol. Both (a) and (b)
7. Which of the following determines the direction of induced emf ?
(A) Ampere's law
(B) Fleming's right-hand rule
(C) Fleming's left-hand rule
(D) Maxwell's cork screw law
Ans(b)
Sol. From Fleming's Right Hand Rule, there is a definite relation among current or induced e.m.f. (electromotive force), lines of force and motion of the conductor.
8. The power of a 25 cm focal length of lens will be—
(A) – 4D (B) +4D
(C) –5D (D) +5D
Ans(d)
Sol. $P=\frac{1}{f}$
where, P = Power (in dioptre)
f = focal length (in meter)
we have, f = 20 cm $=\frac{20}{100}m=\frac{1}{5}m$
$P=\frac{1}{\frac{1}{5}}D=+5D$
9. Dynamo generates—
(A) electron (B) charge
(C) e.m.f. (D) magnetic field
Ans(c)
Sol. E.m.f
10. According to Faraday's law—
(a) $e= +n.\frac{d\emptyset}{dt}$ (b) $e= -n.\frac{d\emptyset}{dt}$
(c) $e= -\frac{1}{n}.\frac{d\emptyset}{dt}$ (d) $e = -n.\frac{dt}{d\emptyset}$
Ans(b)
Sol. $e = -n.\frac{d\emptyset}{dt}$
Induced electromotive force appears the factors that produce it. Therefore, its direction

is opposite to the direction of the factors that produce it. Hence, the right hand side of this equation is negative.

11. The moment of force is known as—
(a) Torque (b) Impulse
(c) Work done (d) None of these
Ans(a)
Sol. Moment of force and torque are the same

12. The unit of energy is—
(a) Joule × second
(b) Joule/second
(c) Kilowatt
(d) Kilowatt-hour
Ans(d)
Sol. Unit of energy is 1 kilowatt-hour which is equal to 3.6$\times 10^6$ *joules*.

13. Coulomb/second is equal to—
(a) Volt (b) Ohm
(c) Watt (d) Ampere
Ans(d)
Sol. Coulomb/second is unit of current, ampere is also unit of current.

14. The function of dynamo is to convert—
(a) Electrical energy into mechanical energy
(b) High voltage into low voltage
(c) Low voltage into high voltage
(d) Mechanical energy into electrical energy
Ans(d)
Sol. Dynamo converts mechanical energy into electrical energy.

15. Momentum has the same unit as that of—
(a) Torque (b) speed
(c) Impulse (d) Moment of momentum
Ans(c)
Sol. Momentum has the same unit as that of impulse.

16. Dimensional formula of momentum is—
(A) $[MLT^{-2}]$ (B) $[MLT^{-1}]$
(C) [MLT] (D) None of these
Ans(b)
sol. Momentum= mass×velocity
unit of momentum S.I= kg. meter/sec
so dimensional formula of momentum is $[MLT^{-1}]$

17. From the top of a building, a ball is dropped with an acceleration of 9·8 m/s^2. After 4seconds, its velocity will be—
(A) 9·8 m/sec
(B) 19·6 m/sec
(C) 29·4 m/sec
(D) 39·2 m/sec
Ans(d)
Sol.
(C) Let required velocity be = V m/sec
... V=U + *gt*
⇒V = 0 + 9·8 × 4
∴V = 39·2 m/sec

18. The transformer used to decrease the magnitude of the alternating voltage is a—
(a) Step-up transformer
(b) Step-down transformer
(c) Step-in transformer
(d) Step-out transformer
Ans(b)
Sol.A step down transformer has less turns on the secondary coil that the primary coil. The induced voltage across the secondary coil is less the applied voltage across the primary coil.

19. A device used to stabilize the voltage supplied by electric supply station is a—
(a) Dynamo (b) Transformer
(c) Ammeter (d) Generator
Ans(b)
Sol.**Dynamo -** is an electrical generator that creates direct current using a commutator.
Transformer- Transformers are capable of either increasing or decreasing the voltage and current levels of their supply, without modifying its frequency, or the amount of electrical power being transferred from one winding to another via the magnetic circuit.
Ammeter- An ammeter is a measuring instrument used to measure the current in a circuit.
Generator- In electricity generation, a generator is a device that

converts motive power (mechanical energy) into electrical power

20. Water is _____________ elastic than air.
(a) more (b)less
(c) equally (d)none of these
Ans(a)
Sol.Water is more elastic than
air because air is more compressible than water. We know that
volumetric elasticity is reciprocal of compressibility; therefore water is
more elastic than air.

21. The adiabatic elasticity of a gas is equal to-
(A) γ × density
(B) γ × volume
(C) γ × pressure
(D) γ × specific heat
Ans(c)
Sol.

22.Electrostatic precipitation is used to control?
(a) Water pollution
(b) Solid waste
(c) Noise pollution
(d) Air pollution
Ans (d)
Sol.
Air pollution : An electrostatic precipitator (ESP) is a filtration device that removes fine particles, like dust and smoke.

23. What is the process responsible for producing photons in a laser diode ?
(a)Fermi level shift
(b)Majority carrier injection
(c)Carrier freeze out
(d)Electron-hole recombination
Ans(d)
Sol. Electron-hole recombination - A laser diode is electrically a PIN diode. The active region of the laser diode is in the intrinsic (I) region and the carriers **(electrons and holes)** are pumped into that region from the N and P regions respectively

24. what is the unit of pressure in the SI system?
(a)Watt
(b)joule
(c)pascal
(d)Newton
Ans.(c)
Sol. Pressure—the effect of a force applied to a surface—is a derived unit, obtained from combining base units. The unit of pressure in the SI system is
the **pascal**(Pa)

25. A passenger standing in a bus is thrown outward when the bus takes a turn This happens due to _____?
(a)Outward pull on him
(b)Inertia of motion
(c)Change in momentum
(d)Change in acceleration
Ans(a)
Sol.
when the bus takes a turn there is an outward pull on the passenger standing in the bus

26. Longitudinal waves cannot travel through?
(a)Vacuum
(b)Solid
(c)Liquid
(d)Gas
Ans(a)
Sol. Sound is produced by vibrating particles that form longitudinal waves. Longitudinal waves have to travel through a medium. They cannot travel through a vacuum because they need particles to vibrate. Only electromagnetic waves can travel through a vacuum, and all electromagnetic waves are transverse waves. Therefore, no, longitudinal waves cannot travel through a vacuum.

27. When a bullet is fired upward vertically, it gains _______.
(a)Speed
(b)Acceleration
(c)Kinetic energy
(d)Potential energy
Ans(d)
Sol.If a bullet is shot STRAIGHT up (90 degrees to the ground), gravity will convert nearly all of its kinetic energy to

potential energy. Falling back to earth, though, does not bring it back to the same velocity. At some point it will hit terminal velocity, slowed by air friction and it will hit the ground at a fraction of its starting speed . In other words, all of its kinetic energy is converted to potential energy in its rise, but much of the potential energy is converted to forms of energy (heat, sound) other than velocity on its return.

28. The pendulum on a wall clock is an example of ______.
(a)Linear motion
(b)Rotational motion
(c)Vibratory motion
(d)None of the above
Ans(c)
Sol.Vibratory motion occurs at a fixed point as an object moves back and forth. It can also be defined as an object forced to move to and fro periodically, occurring when a particle is vibrated. Oscillatory motion is related to vibratory motion. Types of vibratory motion include forced vibratory motion and free vibratory motion. An example of free vibratory motion is when a child is on a swing and the swing is let go after a push.

29. A man jumping out of a moving train due to inertia is thrown-
(a)Backward
(b)Forward
(c)Sideward
(d)Falls flat
Ans(b)
Sol. A man jumping out from a moving train thrown forward due to inertia.

30. Television stations cannot transmit their regional programmes to far off places because ______
(a)these signals are electro magnetic
(b)they are non-electro magnetic
(c)they have large amplitude
(d)they are not reflected by the ionosphere as radio waves.
Ans(d)
Sol. they are not reflected by the ionosphere as radio waves-Television stations cannot transmit their regional programmes to far off places because these are not reflected by the ionosphere as radio waves.

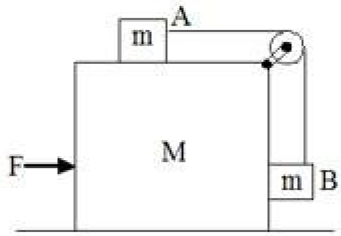
31. The type of rear view mirror in a car is ______.
(a)concave
(b)parabolic
(c)plain
(d)convex
Ans(d)
Sol.
Convex mirrors are curved mirrors that give a compressed view rather than a flat view. As a result, they cover a wider field of view and objects in the mirror appear smaller. Therefore they are used as rear view mirror

32. When you stand close to a fast-moving train, near the edge of the platform you will be sucked towards the train. This is due to _____.
(a)Newton’s Law
(b)Bernoulli’s principle
(c)Archimedes’ principle
(d)None of the above
Ans(b)
Sol. Bernoulli's principle states that an increase in the speed of the fluid occurs simultaneously with a decrease in its pressure. When you stand close to a train which has high speed, the air (fluid) that moves with train has to pass from a channel shaped by your body and train, so, the speed of air has to increase to pass this narrow channel, and thus, the pressure of air between you and train falls dramatically. In this case, the motionless air behind your back has more pressure on your body and you feel that an invisible hand (air pressure force) pushes you towards the train. this force, depending on train(air) speed and your distance to rails, can become as big as 190 Kgf . It means if you stand really close to a high-speed train, the air pressure force will be high enough to push you under the wheels.

33. 'Galvanometer’ measures

(a)Pressure of grass
(b)Sound underwater
(c)Electric current
(d)Relative density of liquids
Ans(c)
Sol. Galvanometer is an instrument for measuring a small electrical current or a function of the current by deflection of a moving coil. The deflection is a mechanical rotation derived from forces resulting from the current.

34. The horizontal surface below the bigger block is smooth. The coefficient of friction between the blocks is μ. The maximum force which can be applied to keep the smaller blocks at rest with respect to the bigger block is



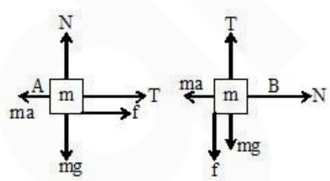
(a) $\frac{(1-\mu)(M+2m)g}{1+\mu}$

(b) $\frac{(1+\mu)(M+m)g}{1-\mu}$

(c) $\frac{(1+\mu)(M+2m)g}{1-\mu}$

(d) (1 +μ) (M+ 2m)g

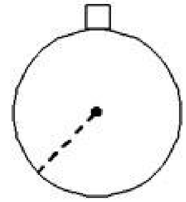
Ans:(c)
Sol.



$\left.\begin{array}{l} T+\mu mg = ma \\ T = \mu ma + mg \end{array}\right\} a = \left(\frac{1+\mu}{1-\mu}\right)g$

$\bar{A}.(B + C)$

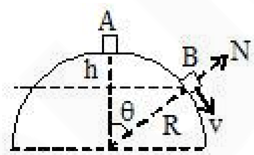
34. A small particle is placed over a sphere of radius R. It leaves the sphere at _______ from top if it starts sliding



(a) $\frac{R}{3}$ (b) $\frac{2R}{3}$

(c) R (d) None

Ans:(a)
Sol.



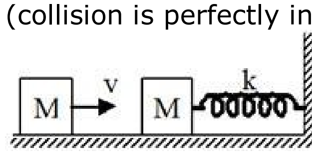
N = 0 V = $\sqrt{gR\cos\theta}$

From energy conservation

$\frac{1}{2}$ mv^2 = mgR(1 − cos□)

So cos□ = $\frac{2}{3}$ & h = $\frac{R}{3}$

35. A block of mass M moving with velocity v hits another block at rest connected to a spring of spring constant k. The maximum compression of the spring is (collision is perfectly inelastic).



(a) $\sqrt{\frac{mv^2}{2k}}$ (b) $\sqrt{\frac{mv^2}{k}}$

(c) $\sqrt{\frac{2mv^2}{3k}}$ (d) None

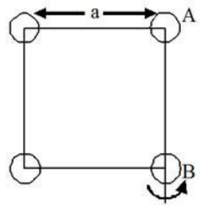
Ans: (a)
Sol.

Mv = 2mv^1□ v^1 = v/2
& from energy law

$\frac{1}{2}kx^2 = \frac{1}{2}$ (2m) (v/2)2

x = $\sqrt{\frac{mv^2}{2k}}$

36. Four spheres each of mass m and radius are fixed at the vertices of a square (Skelton) of side (a) It is rotated about side A(B) The MOI is



(a) $4\left\{\frac{2}{5}mr^2\right\}$

(b) $4\left\{\frac{2}{5}mr^2\right\}+ma^2$

(c) $4\left\{\frac{2}{5}mr^2\right\}+2\times ma^2$

(d) $4\left\{\frac{2}{5}mr^2\right\}+4\times ma^2$

Ans: (c)
Sol.

I = $4\left\{\frac{2}{5}mr^2\right\}+2\times ma^2$

37. A uniform rod of length L and mass M lies on a frictionless table is free to move on the table. A particle of mass m moving with velocity u collides elastically with the rod at a distance L/3 from its center and comes to rest immediately after collision. The ratio $\frac{M}{m}$ is:

(a) 3 : 7 (b) 1 : 3
(c) 3 : 1 (d) 7 : 3

Ans: (d)
Sol.

mu = Mv ......(1)

$mu\left(\frac{L}{3}\right) = I\omega$ ......(2)

from (1) & (2) $\frac{v}{\omega}=\frac{L}{4}$

By conservation of energy

$\frac{1}{2}mu^2 = \frac{1}{2}I\omega^2 + \frac{1}{2}Mv^2$

So $\frac{M}{m}=\frac{7}{3}$

38.A current of 4 amperes passes through a resistance wire connected across the potential difference of 15 volts for 3 minutes. The energy consumed in wire will be—
(a) 12400 joules
(b) 14400 joules
(c)10800 joules
(d) 45000 joules
Ans(c)
Sol. I = 4 amperes, V = 15 volt
t = 3 minutes = 180 seconds, W = ?
Formula :W = V.I.*t*
= 15 × 4 × 180 joules
= 10800 joules

39.Magnitude of induced emf produced in a coil when a magnet is inserted into it, depends not on the –
(a) Number of turns in the coil
(b) Resistance of the coil
(c) Magnetic moment of the magnet
(d) Speed of approach of the magnet
Ans(b)
Sol. Induced emf e=$\frac{\Delta\phi}{\Delta t}$
Or, e=$\frac{nBA}{t}$
As given in formula, no. of turns increases, induced emf increases.
And more is the magnetic moment of the magnet, more is the magnetic field produced by it hence is the induced emf.
With increase in the speed of the magnet, change in magnetic flux linked with coil changes, hence induced emf changes.
Hence, magnitude of induced e.m.f does not depends on resistance of the coil.

40. A Sonometer wire is 31cm long is in resonance with a tuning fork of frequency n. If the length is increased by 1cm and it is vibrated with the same tuning fork, then 8 beats/sec are hear(d) The frequency of the tuning fork is –

(a) 248Hz (b) 256Hz
(c) 264Hz (d) None

Ans: (b)
Sol.

$n = \frac{1}{l}$

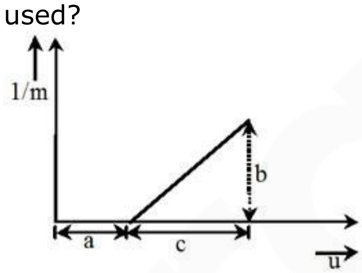
$\frac{n_1}{n_2} = \frac{l_2}{l_1}$

$\frac{n}{n-8} = \frac{32}{31}$

31n = 32n – 256

n = 256

41. The graph in figure shows how the inverse of magnification 1/m produced by a convex thin lens varies with object distance u. What was the focal length of the lens used?



(a) $\frac{b}{c}$ (b) $\frac{b}{ca}$
(c) $\frac{bc}{a}$ (d) $\frac{c}{b}$

Ans: (d)
Sol.

$m = \frac{f}{u+f}$

$\frac{1}{m} = \frac{u+f}{f} = 1 + \frac{u}{f}$

□ Slope = tan□ = $\frac{1}{f} = \frac{b}{c}$

or f = $\frac{c}{b}$

42. The effective focal length of the lens combination shown in the figure is –60 cm. The radii of curvature of the curved surfaces of the Plano-convex lenses are 12 cm each and refractive index of the material of the lens is 1.5. The refractive index of the liquid is:

(a) 1.33 (b) 1.42
(c) 1.53 (d) 1.6

Ans: (d)
Sol.

For plano-convex lens

$f = \frac{R}{\mu_p - 1}$

for biconvex lens

$f = \frac{R}{2(\mu - 1)}$

$\therefore \frac{1}{f_{eff}} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$

$\Rightarrow \frac{2(\mu_1 - 1)}{R} + \frac{2(\mu_2 - 1)}{R} = -\frac{1}{60}$

$\mu_2 = 1.6$

43. In a double slit experiment, the distance between the slits is (d) The screen is at a distance D from the slits. If a bright fringe is formed opposite of one of the slits, find its order:

(a) $\frac{d}{\lambda}$ (b) $\frac{\lambda^2}{dD}$
(c) $\frac{D^2}{2\lambda d}$ (d) $\frac{d^2}{2D\lambda}$

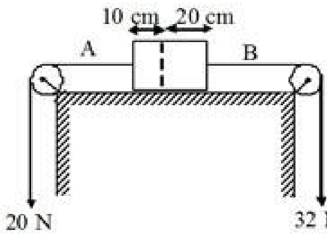
Ans: (d)
Sol.

For B-fringe just opposite to one slit

$x = \frac{n\lambda D}{d}$

$\frac{d}{2} = \frac{n\lambda D}{d} \Rightarrow n = \frac{d^2}{2D\lambda}$

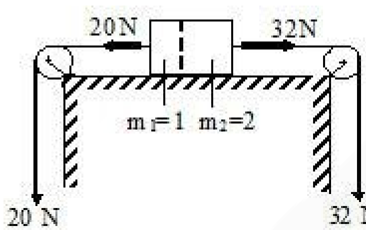
44. Figure shows a uniform rod of mass 3 kg and of length 30 cm. The strings shown in figure are pulled by constant forces of 20 N and 32 N .The acceleration of the rod is-



(a) 2 m/s^2 (b) $3m/s^2$
(c) $4m/s^2$ (d) $6m/s^2$

Ans: (c)

Sol.



$32 - 20 = 3a$

$12 = 3a$

$a = 4\ m/s^2$

45.The value of electric energy will be—

(a) I^2Rt (b) $\frac{I^2}{Rt}$

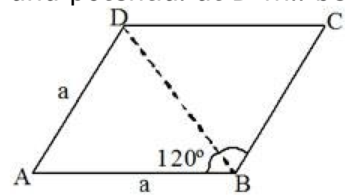
(c) $\frac{I^2}{R}$ (d) $\frac{I^2 R}{t}$

Ans(a)

Sol. Let W is electrical power, then

$W = I^2Rt = VIt = \frac{V^2 t}{R} [\because V = I.R]$

46. A charge +Q at A (See electric potential figure) produces electric field E and V at (D) If we now put charges – 2Q and +Q at B and C respectively, then the electric field and potential at D will be –

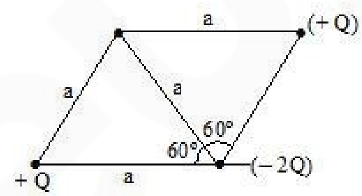


(a) E and 0 (b) 0 and V

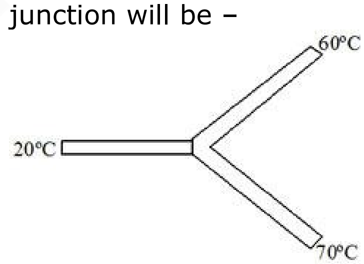
(c) $\sqrt{2}E$ and $\frac{V}{\sqrt{2}}$ (d) $\frac{E}{\sqrt{2}}$ and $\frac{V}{\sqrt{2}}$

Ans: (a)

Sol.



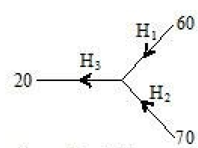
47. Three identical thermal conductors are, connected as shown in figure. Considering no heat loss due to radiation, temperature at the junction will be –



(a) 40°C (b) 60°C
(c) 50°C (d) 35°C

Ans: (c)

Sol.

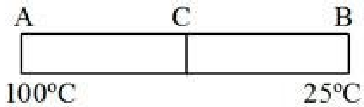


$H_3 - H_1 + H_2$

$\frac{kA}{l}(\theta - 20) = \frac{kA}{l}(60 - \theta) + \frac{KA}{l}(70 - \theta)$

$3\theta = 150$ $\theta = 50°\ C$

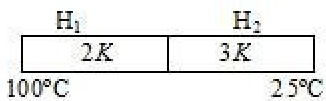
48. Two identical rods AC and CB made of two different metals having thermal conductivities in the ratio 2 : 3 are kept in contact with each other at the end C as shown in the figure. A is at 100°C and B is at 25°(C) Then the junction C is at –



(a) 55°C (b) 60°C
(c) 75°C (d) 50°C

Ans: (a)

Sol.



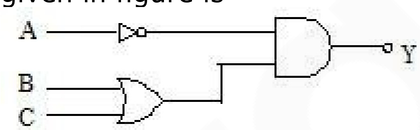
$H_1 = H_2$

$\frac{2kA}{l}(105\ \theta) = \frac{3kA}{l}(\theta - 25)$

$200 - 2\theta = 3\theta - 75$

$\theta = 55$

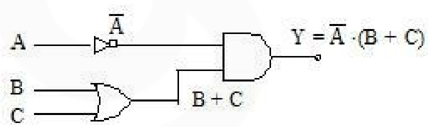
49. The Boolean equation for the circuit given in figure is



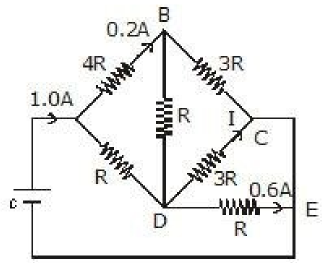
(a) Y= A.B + C
(b) Y = A .(B + C)
(c) Y =A .(B + C)
(d) Y = $\bar{A}.(B + C)$

Ans: (d)

Sol.



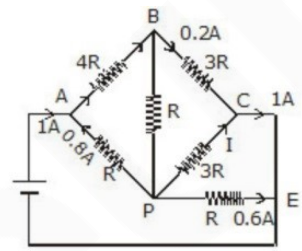
50. The current I in the circuit shown in the figure is –



(a) 0 (b) 0.1 A
(c) 0.4 A (d) 0.2 A

Ans: (d)

Sol.



If current in AB is 0.2 A hence current in AD is 0.8A

$\therefore V_A - V_B = 0.2 \times 4R = 0.8\ R$

$V_A - V_D = 0.8 \times R = 0.8\ R$

$\therefore V_B - V_D = 0$

This means that no current will flow in R

$\therefore$ current in 3R will be 0.2A

51. A particle is released from a height H. At certain height its kinetic energy is two times its potential energy. Height and speed of particle at that instant are

(a) $\frac{H}{3}, \frac{\sqrt{2gH}}{3}$ (b) $\frac{H}{3}, \frac{2\sqrt{gH}}{3}$

(c) $\frac{2H}{3}, \frac{\sqrt{gH}}{3}$ (d) $H_3, \sqrt{2gh}$

Ans: (b)

Sol.

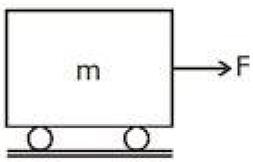
$(mgH - mgh) = 2\ mgh$

$\therefore h = \frac{H}{3}$

$v = \sqrt{2g(H-h)}$

$= \sqrt{2g\left(\frac{2H}{3}\right)} = 2\sqrt{\frac{gH}{3}}$

52. A car of mass m is accelerating on a level smooth road under the action of a single force F. The power delivered to the car is constant and equal to P. If the velocity of the car at an instant is v, then after travelling how much distance it becomes double?



(a) $\frac{7mv^3}{3p}$ (b) $\frac{4mv^3}{3p}$

(c) $\frac{mv^3}{9}$ (d) $\frac{18mv^3}{7p}$

Ans: (a)
Sol.

$P = F.v = m\left(v.\frac{dv}{ds}\right).v$

$\therefore \int_v^{2v} v^2.dv = \frac{P}{m.}\int_0^s ds$

$\left[\frac{v^3}{3}\right]_v^{2v} = \frac{PS}{m}$ or $S = \frac{7mv^3}{3P}$

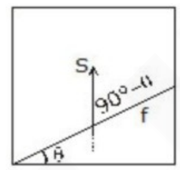
53. A small block of mass m is kept on a rough inclined surface of inclination θ fixed in an elevator. The elevator goes up with a uniform velocity v and the block does not slide on the wedge. The work done by the force of friction on the block in a time t will be

(a) zero (b) mgvt $\cos^2\theta$

(c) mgvt $\sin^2\theta$ (d) $\frac{1}{2}$mgvt sin 2θ

Ans: (c)
Sol.

Block does not slide. Hence force of friction.



$f = mg \sin\theta$

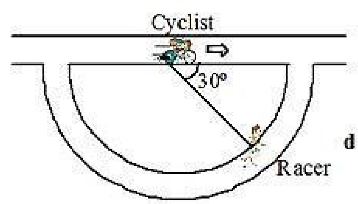
In time t, displacement S = vt

$\therefore W_f = f.\ s.\cos(90° - \theta)$

$= (mg \sin\theta)(vt)(\sin\theta)$

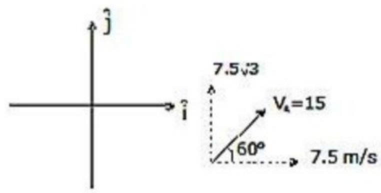
$= mgvt \sin^2\theta$

54. A cyclist is moving with a constant acceleration of 1.2 m/s^2 on a straight track. A racer is moving on a circular path of radius 150 m a0194t constant speed of 15 m/s. Find the magnitude of velocity of racer which is measured by the cyclist has reached a speed of 20 m/s for the position represented in the figure –



(a) 18.03 m/s (b) 25 m/s
(c) 20 m/s (d) 15 m/s

Ans: (a) Sol.
:



$\vec{V}_c = 20 m/s\,\hat{i}$ $\quad\quad$ $\vec{V}_R = 7.5\hat{i} + 7.5\sqrt{3}\hat{i}$

$\vec{V}_{RC} = 7.5\hat{i} + 7.5\sqrt{3}\hat{i} - 20\hat{i}$

$|\vec{V}_{RC}| = \sqrt{(12.5)^2 + (7.5\sqrt{3})^2}$

$= 18.027$ m/sec

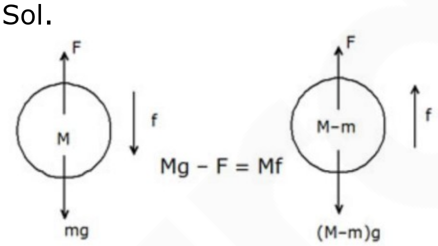
55. A balloon of mass M and a fixed size starts coming down with an acceleration f(f<g). The ballast mass m to be dropped from the ballon to have it go up with an acceleration f. Assuming negligible air resistance is find the value of m

(a) $\left(\frac{M}{g+f}\right)f$ $\quad$ (b) $\frac{Mf}{2(g+f)}$

(c) $\left(\frac{2Mf}{g+f}\right)$ $\quad$ (d) $\frac{M(g+a)}{g}$

Ans: (c)

Sol.



$F - (M-m)g = (M-m)f$

$m(g+f) = Mg + mf - Mg + Mf$

$m = \frac{2mf}{(g+f)}$

56. The apparent frequency of a note is 200 Hz. When a listener is moving with a velocity of 40 ms^{-1} towards a stationary source. When he moves away from the same source, the apparent frequency of the same note is160Hz. the velocity of sound in air in m/s is:

(a) 340 $\quad$ (b) 330

(c) 360 $\quad$ (d) 320

Ans: (c)

Sol.

$200 = \left(\frac{v+40}{v}\right)f$ $\quad$ $160 = \left(\frac{v-40}{v}\right)f$

$v = 360$ m/s

57. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is –

(a) $\left(\sqrt{I_1}+\sqrt{I_2}\right)^2$ $\quad$ (b) $\left(\sqrt{I_1}-\sqrt{I_2}\right)^2$

(c) $I_1 + I_2$ $\quad$ (d) $2(I_1 + I_2)$

Ans: (d)

Sol.

$I_{max} = I_1 + I_2 + 2\sqrt{I_1 I_2}$

$I_{min} = I_1 + I_2 - 2\sqrt{I_1 I_2}$

$I_{max} + I_{min} = 2(I_1 + I_2)$

58. According to Ohm's law the correct relation between potential difference and current is—

(a) $V \propto i$ $\quad$ (b) $V \propto \frac{i}{q}$

(c) $V \propto \frac{1}{i}$ $\quad$ (d) None of these

Ans(a)

Sol. **Ohm's law**—This law states that the current flowing in an electric circuit is directly proportional to the voltage applied to the circuit.

If *i* is the current flowing in a circuit and V is the voltage applied, then

$V \propto i$

Or

$\frac{V}{i}$ = R (constant)

59. If two resistances R1 and R2 are connected in series, then the value of their equivalent resistance R will be—

(a) R1 – R2 $\quad$ (b) R1 × R2

(c) R1 + R2 (d) $\frac{1}{R1}+\frac{1}{R2}$

Ans(c)

Sol.

if resistances R1 and R2 are connected in series then their equivalent resistance R = R_1+R_2

And, if resistances R1 and R2 are connected in Parallel then their equivalent resistance $\frac{1}{R}=\frac{1}{R1}+\frac{1}{R2}$.

60. The correct relation is—

(a) 1 watt $=\frac{1volt}{1amp}$

(b) 1 watt = 1 volt × 1 amp

(c) 1 watt $=\frac{1}{1\text{ volt}\times 1\text{ amp}}$

(d) 1 watt $=\frac{1amp}{1volt}$

Ans(b) Power = Voltage × Current

1 Watt = 1 Volt × 1 Amp.

61. Planck's constant has the dimensions of-

(a)Power

(b) Electric charge

(c)Angular momentum

(d) Linear momentum

Ans(c)

Sol. We know that the Planck's constant can be expressed as h=Ev, where E is energy and v is frequency. From dimensional analysis, we can conclude that Planck's constant has a dimension ML^2T^{-1}.

62. The intensity of the electric field has the unit-

(a) newton/coulomb

(b) newton/ampere

(c) ampere/newton

(d) none of these

Ans(a)

Sol.

The standard metric units on electric field strength arise from its definition. Since electric field is defined as a force per charge, its units would be force units divided by charge units. In this case, the standard metric units are Newton/Coulomb or N/C.

63.For total internal reflection, the angle of incidence always

(a) Less than critical angle

(b)Greater than critical angle

(c)Equal to critical angle

(d) None of these

Ans(b)

Sol. This is called **total internal reflection**. The conditions **for total internal reflection** are: light is travelling from an optically denser medium (higher refractive index) to an optically less dense medium (lower refractive index). the **angle of incidence** is greater than the critical **angle**.

64. The majority carriers of electricity in a N–type semiconductor are

(a)Free electrons

(b)Holes

(c)Both free electrons and holes

(d)Promotion of heavy and basic industries

Ans.(a)

Sol. There are two recognized types of charge carriers in semiconductors. One is electrons, which carry a negative electric charge. In addition, it is convenient to treat the traveling vacancies in the valence band electron population (holes) as a second type of charge carrier, which carry a positive charge equal in magnitude to that of an electron. Free electrons are the majority carriers of electricity in a N–type semiconductor.

65. The band gap of silicon at room temperature is –

(a) 1.3ev (b) 0.7ev

(c) 1.1ev (d) 1.4ev

Ans(a)

Sol. Silicon (Si), with a band gap at room temperature of ~1.12 eV.

66.Zener diode is used as the main component in DC power supply for

(a)Rectification

(b) Voltage regulation

(c) Filter action

(d) Both (A) and (B)

Ans(b)

Sol. Zener diodes are widely used as voltage references and as shunt regulators to regulate the voltage across small circuits. When connected in parallel with a variable voltage source so that it is reverse biased, a Zener diode conducts when the voltage reaches the diode's reverse breakdown voltage. From that point on, the relatively low impedance of the diode keeps the voltage across the diode at that value.

67. In radar systems PRF stands for –

(a) Power Return Factor

(b)Pulse Return Factor

(c) Pulse Repetition Frequency

(d) Pulse Response Factor

Ans(c)

Sol.The **pulse repetition frequency** (**PRF**) is the number of pulses of a repeating signal in a specific time unit, normally measured in **pulses per second**.

68. If C_p and C_v denote the specific heat of nitrogen per unit mass at constant pressure and constant volume respectively, then -

(a)$C_p - C_v = 28R$

(b)$C_p - C_v = R/28$

(c)$C_p - C_v = R/14$

(d)$C_p - C_v = R$

Ans(b)

Sol. $m(C_p) - m(C_v) = R$

$C_p - C_v = \frac{R}{28}$

69. Young's modulus is defined for

(a) solid (b) liquid

(c) gas (d) All of the above

Ans(a)

Sol. **Young's modulus** or **Young modulus** is a mechanical property that measures the stiffness of a solid material. It defines the relationship between stress (force per unit area) and strain (proportional deformation) in a material in the linear elasticity regime of a uniaxial deformation.

70. If angle of prism is 60º and refractive index $\sqrt{2}$then angle of minimum deviation-

(a) 30º (b) 45º

(c) 90º (d) 60º

Ans(a)

Sol. $\mu = \frac{\sin(\frac{A+D_m}{2})}{\sin(\frac{A}{2})}$

$\sqrt{2} = \frac{\sin(\frac{60+D_m}{2})}{\sin 30^\circ}$

$\sin\left(\frac{60+D_m}{2}\right) = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}} = \sin 45^\circ$

$\left(\frac{60+D_m}{2}\right) = 45^\circ$

$D_m = 30^\circ$

71.The most important advantage of nuclear energy is :

(a) less time is required to generate the energy

(b) a small nuclear fuel is sufficient to produce huge amount of energy

(c) less safety measures are sufficient

(d) many operational difficulties are not there

Ans(b)

Sol. advantage of nuclear energy is the required amount of fuel: less fuel offers more energy. It represents a significant save on raw materials but also in transport, handling and extraction of nuclear fuel. The cost of nuclear fuel (overall uranium) is 20% of the cost of energy generated.

72. Moderator is used to

(a)Accelerate the bombarding neutrons

(b) Slow down the bombarding neutrons

(c)To eject more electrons

(d)To arrest the nuclear reaction

Ans(b)

Sol. In nuclear engineering, a neutron moderator is a medium that reduces the speed of fast neutrons, thereby turning them into thermal neutrons capable of sustaining a nuclear chain reaction involving uranium-235 or a similar fissile nuclide.

73. The control rod in a nuclear reactor is made of

(a)Uranium

(b)Cadmium

(c)Plutonium
(d)Graphite
Ans(b)
Sol. Control rods are used in nuclear reactors to control the fission rate of uranium and plutonium. They are composed of chemical elements such as boron, silver, indium and **cadmium** that are capable of absorbing many neutrons without themselves fissioning.

74. Which of the following isotopes normally fissionable-
(a)$^{92}U_{233}$ (b) $^{92}U_{235}$
(c) $^{92}U_{239}$ (d) $^{92}U_{240}$
Ans(b)
Sol. The isotope uranium-235 is important for both nuclear reactors and nuclear weapons because it is the only isotope existing in nature to any appreciable extent that is fissile, that is, can be broken apart by thermal neutrons.

75.A current of 5 amperes passes through a resistance wire connected across the potential difference of 20 volts for 2 minutes. The energy consumed in wire will be—
(a) 12000 joules
(b) 14400 joules
(c)10800 joules
(d) 45000 joules
Ans(a)
Sol. I = 5 amperes, V = 20 volt
t = 2 minutes = 120 seconds, W = ?
Formula :W = V.I.t
= 20× 5× 120 joules
= 12000 joules