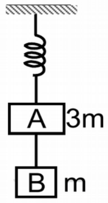
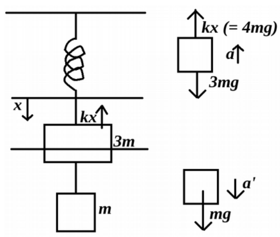
NEET 2017

Two blocks A and B of masses 3m and m respectively are connected by a massless and inex string. The whole system is suspended by a massless spring as shown in figure. The magnit acceleration of A and B immediately after the string is cut, are respectively :



(1) g, $\frac{g}{3}$ (2) $\frac{g}{3}$, g (3) g, g (4) $\frac{g}{3}$, $\frac{g}{3}$

1. <u>Sol^n:</u> As taught directly in Numerical Class of Newton's Law of Motion



In equilibrium, = 4mg

When string is cut, T = 0

a) Σf_{ext} = m.a => 4mg – 3mg = 3 m.a :. a = g/3

b) mg = ma' => a = g' :. ANS: (2) g/3 , g

The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then :

(1) d = $\frac{1}{2}$ km (2) d = 1km (3) d = $\frac{3}{2}$ (4) d = 2km

2. <u>Sol^n:</u> Same as that taught directly in Theory class of Variation due to Gravity

g' = g (1 – 2h/R) = g(1- d/R) :. d = 2h = 2 X 1 = 2 km :. ANS: (4)

A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in second is :

(1) $\frac{\sqrt{5}}{\pi}$ (2) $\frac{\sqrt{5}}{2\pi}$ (3) $\frac{4\pi}{\sqrt{5}}$ (4) $\frac{2\pi}{\sqrt{3}}$

3. <u>Sol^n:</u> Same as that taught directly in theory class of SHM

At 2cm from mean, v = a => $\omega\sqrt{A^2 - X^2} = \omega^2 X$ => $A^2 - X^2 = \omega^2 X^2$

$\omega = \sqrt{(A^2 - X^2)/X^2} = \sqrt{(3^2 - 2^2)/2^2} = \sqrt{5}/2$:. $T = 2\pi/\omega = 4\pi/\sqrt{5}$:. ANS: (3)

The resistance of a wire is 'R' ohm. If it is melted and stretched to 'n' times its original length, its new resistance will be

(1) nR (2) $\frac{R}{n}$ (3) n^2R (4) $\frac{R}{n^2}$

4. <u>Sol^n:</u> Same as that taught directly in Theory class of Resistance

$R = \rho l/A$:. A.l = V (volume) = A'.nl'

If the length increases n times, area A will decrease n times to keep the volume same

:. new $R' = \rho l'/A' = \rho.\ Nl/(A/n) = n^2 .\ (\rho l/A) = n^2 R$ => $R' = n^2 R$:.ANS: (3)

A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system :

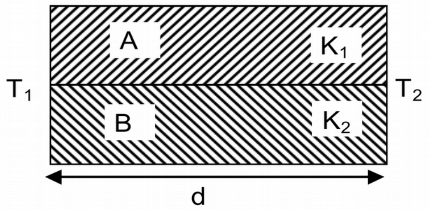
(1) increases by a factor of 4 (2) decreases by a factor 2

(3) remains the same (4) increases by a factor of 2

5. **Sol^n:** Same as that taught directly in Numerical class of Capacitors Q. (40) in H. C. V.

$U_i = 1/2\ CV^2$, $U_f = 2 \times 1/2\ C\ .(V/2)^2 = CV^2/4$:. $U_i/U_f = 1/2$:. ANS: (2)

Two rods A and B of different materials are welded together as shown in figure. Their conductivities are K_1 and K_2. The thermal conductivity of the composite rod will be



(1) $\frac{K_1+K_2}{2}$ (2) $\frac{3(K_1+K_2)}{2}$ (3) $K_1 + K_2$ (4) $2(K_1 + K_2)$

6. **Sol^n:** Same as that taught directly in Theory Class of Thermal Conduction

In parallel $1/R = 1/k_1 + 1/k_2$ => $k.\ 2A/L = k_1A/L + k_2A/L$ => $2k = k_1 + k_2$

=> $k = (k_1 + k_2)/2$:.ANS: (1)

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7. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

(1) 10 hz (2) 20 Hz (3) 30 Hz (4) 40 hz

Sol^n: Same as that taught directly in numerical class Q. (41) of H. C. V.

$v_1/v_2 = n/(n+2) = 220/260 = 11/13$ => $13n = 11n + 22$ => $2n = 22$ => $n = 11$

$v_o = 20$ Hz , $11v_o$ and $13v_o$ (frequencies) :. ANS: (2)

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8. The bulk modulus of a spherical object is'B'. If it is subjected to uniform pressure 'p', the fractional

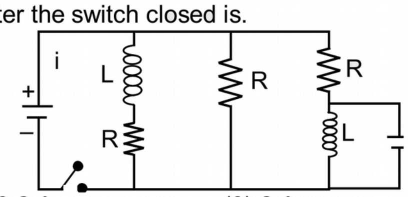
decrease in radius is :

(1) p/B (2) B/3p (3) 3p/B (4) p/3B

Sol^n: Taught Directly in Theory Class of Elasticity (frequencies) (H. C. V. Q. 12, elasticity)

$B = p/(dV/V)$; $dV/V = p/B$; $V = 4/3\ \pi r^3$:. $dV/V = 3.\ dr/r$:. $dr/r = 1/3\ .\ dV/V = 1/3\ .\ p/B = p/3B$

Figure shows a circuit that contains three identical resistors with resistance R = 9.0 Ω each, two identical inductors with inductance L = 2.0 mH each and an ideal battery with emf ε = 18 V. The current 'i' through the battery just after the switch closed is.



(1) 2 mA (2) 0.2 A (3) 2 A (4) 0 ampere

10. Question Wrong ANS: (Bonus)

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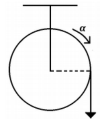
11. One end of string of length □ is connected to a particle of mass ‘m’ and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed ‘v’ the net force on the particle (directed towards center) will be (T represents the tension in the string)

(1) T (2) $T + mv^2/l$ (3) $T - mv^2/l$ (4) zero



Sol^n: Taught directly in Theory Class of Circular Motion

$F = ma$, $T = mv/l$:. Net Force = T :.ANS: (1)

The photoelectric threshold wavelength of silver is 3250×10^{-10} m. The velocity of the electron ejected from a silver surface by ultraviolet light of wavelength 2536×10^{-10} m is :

(Given $h = 4.14 \times 10^{-15}$ eVs and $c = 3 \times 10^{8}\ ms^{-1}$)

(1) $\approx 6 \times 10^{5}\ ms^{-1}$ (2) $\approx 0.6 \times 10^{6}\ ms^{-1}$ (3) $\approx 61 \times 10^{3}\ ms^{-1}$ (4) $\approx 0.3 \times 10^{6}\ ms^{-1}$

12. Sol^n: Taught directly in Theory class of Photoelectric Effect

$1/2\ mv^2 = hc/\lambda - hc/\lambda_o$ $v = 6.0 \times 10^5$ m/s :.ANS: (1), (2)

Radioactive material 'A' has decay constant '8 λ' and material ‘B’ has decay constant ‘λ’. Initially they have same number of nuclei. After what time, the ratio of number of nuclei of material 'B' to that 'A' will be $\frac{1}{e}$?

(1) $\frac{1}{\lambda}$ (2) $\frac{1}{7\lambda}$ (3) $\frac{1}{8\lambda}$ (4) $\frac{1}{9\lambda}$

13. Sol^n: As taught directly in Theory class of Nuclear Physics

$N_A/N_B = e^{-1} = N_o e^{-8\lambda t} / N_o e^{-\lambda t} = e^{-7\lambda t} \Rightarrow 1 = 7\lambda t \Rightarrow t = 1/7\lambda$:. ANS: (2)

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14. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30N?

(1) 25 m/s^2 (2) 0.25 rad/s^2 (3) 25 rad/s^2 (4) 5 m/s^2

Sol^n: As taught directly in Rotational Dynamics as Q.(72) H.C.V.

$\tau_C = I_C . \alpha \Rightarrow 30 \times (0.4) = 3 \times (0.4)^2 \times \alpha$

$\Rightarrow \alpha = 30/(3 \times 0.4) = 100/4 = 25\ rad/s^2$:.ANS: (3)

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15. Two cars moving in opposite directions approach each other with spped of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340 m/s] :

(1) 350 Hz (2) 361 Hz (3) 411 Hz (4) 448 Hz

Sol^n: Same as that taught directly in Theory Class od Doppler’s Effect in Sound

$v' = (V + V_O)/(V - V_S) . N = (340 + 16.5)/(340 - 22) \times 400 = 448$ Hz :. ANS: (4)

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16. A 250 – Turn rectangular coil of length 2.1 cm and width 1.25 cm carries a current of 85 μA are subjected to a magnetic field of strength 0.85T. Work done for rotating the coil by 180o against the torque is :

(1) 9.1 μ J (2) 4.55 μ J (3) 2.3 μ J (4) 1.15 μ J

Sol^n: Same as that taught directly in Theory Class of Electromagnetism first chapter

B = NIA ; V = $250 \times 85 \times 10^{-6} \times 2.1 \times 1.25 \times 10^{-4} \times 0.85$
P.E., U = - $\mu \cdot B$ Work done, W = 2U = 9.1×10^{-6} J = 9.1 μJ :. ANS: (1)

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17. A long solenoid of diameter 0.1 m has 2×10^4 turn per meter. At the centre of the solenoid, a coil of100 turns and radius 0.01 m is placed with its axis coinciding with the solenoid axis. The current in the solenoid reduces at a constant rate to 0A from 4 A in 0.05 s. If the resistance of the coil is $10\pi^2 \Omega$, the total charge flowing through the coil during this time is :

(1) 32 π μC (2) 16 μC (3) 32 μC (4) 16 πμC

<u>Sol^n:</u> Same as that taught directly in Numerical Class Q. (98) of H.C.V. in E.M.I

Total Charge, $q = \Delta\Phi_B / R = \{N. (\mu_0 ni).\pi R^2 / \Delta t\} / 10\pi^2$
$= \{100 \times 4\pi \times 10^{-7} \times 2 \times 10^4 \times (4/0.05) \times \pi \times (0.01)^2\}/10\pi^2$
$= 32 \times 10^{-6}$ C = 32 μC :.ANS: (3)

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19. Two astronauts are floating in gravitational free space after having lost contact with their spaceship.The two will :

(1) keep floating at the same distance between them (2) move towards each other
(3) move away from each other (4) will become stationary

<u>Sol^n:</u> Same as taught directly in Theory Class of Gravitation in weightlessness in Spaceships

The astronaut will have a net natural gravitational attraction and hence will get attracted very gradually. :. ANS: (2)

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20. The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is

(1) 2 (2) 1 (3) 4 (4) 0.5

<u>Sol^n:</u> Same as that taught directly in Theory Class of Hydrogen Spectra

$\lambda_B / \lambda_L = 13.6 / 3.4 = 4$:. ANS: (3)

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22. A thin prism having refracting angle 10° is made of glass of refractive index 1.42. This prism is combined with another thin prism of glass of refractive index 1.7. This combination produces dispersion without deviation. The refracting angle of second prism should be :

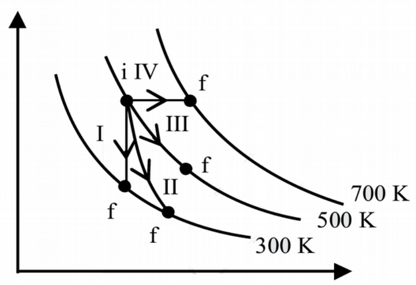
(1) 4° (2) 6° (3) 8° (4) 10°

<u>Sol^n:</u> As taught directly in Theory Class of Dispersion without Deviation Q.(1) H.C.V

$\Sigma\delta = 0 \Rightarrow \delta + \delta' = 0 \Rightarrow (\mu - 1)A + (\mu' - 1)A' = 0 \Rightarrow A' = (1.42 - 1)/(1.7 - 1) \times 10^0 = 6$:.ANS: (2)

23.

Thermodynaic processes are indicated in the following diagram:



Match the following :

	Column-I		Column-2
P	Process I	a.	Adiabatic
Q	Process II	b.	Isobaric
R	Process III	c.	Isochoric
S	Process IV	d.	Isothermal

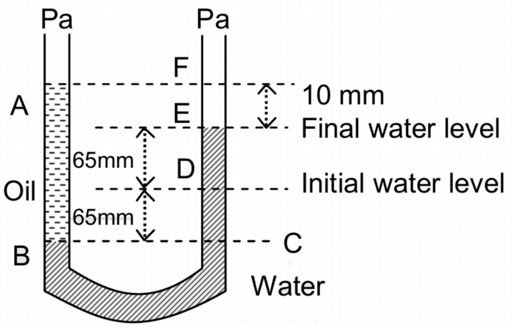
(1) $P \to a,\ Q \to c,\ R \to d,\ S \to b$ (2) $P \to c,\ Q \to a,\ R \to d,\ S \to b$
(3) $P \to c,\ Q \to d,\ R \to b,\ S \to a$ (4) $P \to d,\ Q \to b,\ R \to a,\ S \to c$

Sol^n: Same as that directly in Theory Class of Thermodynamics

Adiabatic Curves are steeper than isothermal p-v curves :.ANS: (2)

24.

A U tube with both ends open to the atmosphere, is partially filled with water. Oil, which is immiscible with water, is poured into one side until it stands at a distance of 10 mm above the water level on the other side. Meanwhile the water rises by 65 mm from its original level (see diagram). The density of the oil is :



(1) 650 kg m^{-3} (2) 425 kg m^{-3}

(3) 800 kg m^{-3} (4) 928 kg m^{-3}

Sol^n: Same as that taught directly in Theory Class of Fluid Mechanics

Pressure at same horizontal level in same same liquid (unaccelerated) are equal.

$p_1 = p_2$ (at lowest level) => $\rho_0 gh_0 = \rho_w gh_w$ =>ρ_0 x 140 = 1000 x 130

=> ρ_0 = 1000 x 130 / 14 = 500 x 13 / 7 = 6500/7 = 928 kg/m^3 :.ANS: (4)

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25. A spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k'. Then they are connected in parallel and force constant is k". Then k' : k" is :

(1) 1 : 6 (2) 1 : 9 (3) 1 : 11 (4) 1 : 14

Sol^n: Same as taught directly in Theory Class of S.H.M (Combination of Springs)

Stiffness, k α 1/l :. l -> 1 : 2 : 3 => k = 3 : 2 : 1

In series, 1/k' = 1/3 + 1/2 + 1/1 = 11/6

In parallel, k'' = 3 + 2 + 1 = 6 :. k : k' = (6/11)/6 = 1/11 :.ANS: (3)

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26. Which of the following statements are correct?

(a) Centre of mass of a body always coincides with the centre of gravity of the body.

(b) Centre of mass of a body is the point at which the total gravitational torque on the body is zero.

(c) A couple on a body produce both translational and rotational motion in a body.

(d) Mechanical advantage greater that one means that small effort can be used to lift a large load.

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

Sol^n: Directly taught in Theory Class of System of Particles

ANS: (1)

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27. A beam of light from a souce L is incident normally on a plane mirror fixed at a certain distance x from the source. The beam is reflected back as a spot on a scale placed just above the source L. When the mirror is rotated through a small angle θ, the spot of the light is found to move through a distance y on the scale. The angle θ is given by :

(1) y/2x (2) y/x (3) x/2y (4) x/y

Sol^n: Same as that taught directly in Theory Class og Geometrical Optics

When mirror is rotated by angle θ, reflected ray rotates by angle 2θ

:. 2θ = y/x :. θ = y/2x :.ANS: (1)

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28. A gas mixture consists of 2 moles of O2 and 4 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is :

(1) 4 RT (2) 15 RT (3) 9 RT (4) 11 RT

<u>Sol^n:</u> Same as taught directly in Theory Class of Thermodynamics

$U = U_1 + U_2 = n_1 \,.\, 5/2R \,.\, \Delta T + \ n_2 \,.\, 3/2R \,.\, \Delta T = \ 2 \times 5/2R \,.T + 4 \times 3/2R \,.T = 11RT$:.ANS: (4)

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29. Consider a drop of rain water having mass 1 g falling from a height of 1 km. It hits the ground with a speed of 50 m/s. Take 'g' constant with a value 10 m/s^2. The work done by the (i) gravitational force and the (ii) resistive force of air is :

(1) (i) – 10 J (ii) – 8.25 J (2) (i) 1.25 J (ii) – 8.25 J

(3) (i) 100 J (ii) 8.75 J (4) (i) 10 J (ii) – 8.75 J

<u>Sol^n:</u> Same as that taught directly in Theory Class of Work-Energy Theorem

$W_{\text{by all forces}} = \Delta K$, $mgx - F.x = 1/2.\, mv^2 - 0$

$:.\ F\,.x = mgx - 1/2.mv^2 = 0.001 \times 10 \times 1000 - 1/2 \times 1 \times 10^{-3} \times (50)^2$

$= 10 - 1.25 = 8.75$ J :.ANS: (4)

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30. A carnot engine having efficiency of 1/10 as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amont of energy absorbed from the reservoir at lower temperature is :

(1) 1 J (2) 90 J (3) 99 J (4) 100 J

<u>Sol^n:</u> Same as that taught directly in Theory Class of Thermodynamics

$\eta_{carnot} = 1 - T_2/T_1 = 1/10 \Rightarrow T_2/T_1 = 9/10$, $(COP)_{carnot} = Q_2 / \Delta W = 1 / (T_1/T_2 - 1) = 9$

$:.\ Q_2 = 9\, \Delta W \ = 9 \times 10 = 90$ J :.ANS: (2)

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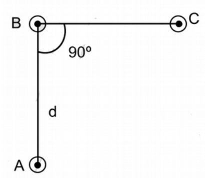
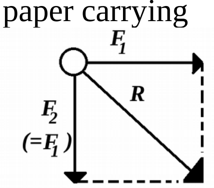
31. An arrangement of three parallel straight wires placed perpendicular to plane of paper carrying same current 'I' along same direction shown in figure. Magnitude of force per unit length on the middle wire 'B' is given by -->





<u>Sol^n:</u> Same as that taught directly in Theory Class of Electromagnetism

For unit length, $F = \sqrt{(F_1^2 + F_2^2)} = F_1\sqrt{2}$

$= (\mu_0 i \,.\, I/ 2\pi d) .\sqrt{2} \ = \ \mu_0 i \,.\, I/ \sqrt{2}\, \pi d$:.ANS: (4)

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32. The x and y corrdinates of the particle at any time are $x = 5t - 2t^2$ and $y = 410t$ respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t = 2s is :

(1) 0 (2) 5 m/s^2 (3) – 4m/s^2 (4) – 8 m/s^2

<u>Sol^n:</u> Same as that taught directly in Theory Class of Kinematics

$V_X = dx/dt = 5 - 4t$; $a_x = dV_x /dt = -4$

$V_Y = dx/dt = 410$; $a_x = dV_x /dt = 0$ $a = a_x = -4$ m/s^2 :.ANS: (3)

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33. The ratio of resolving powers of an optical microscope for two wavelengths $\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å is :

(1) 8 : 27 (2) 9 : 4 (3) 3 : 2 (4) 16 : 81

<u>Sol^n:</u> Same as that taught directly in Theory Class of Optical Instruments

$R = 2\mu \sin\theta / \lambda$ $:.\ R_1/R_2 = \lambda_2/\lambda_1 = 600/400 = 3/2$:.ANS: (3)

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35. A spherical black body with a radius of 12 cm radiates 450 watt power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be :
(1) 225 (2) 450 (3) 1000 (4) 1800
Sol^n: Same as that taught directly in Theory Class of Radiation

(Stefan's Law) $u = \sigma AT^4 = \sigma . 4\pi R^2 . T^4 = 450$ W
$u' = \sigma . 4\pi (R/2)^2 . (2T)^4 = 4u = 4 \times 450 = 1800$ W :.ANS: (4)

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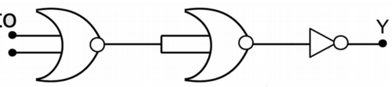
36. A potentiometer is an accurate and versatile device to meke electrical measurements of E.M.F. because the method involves :
(1) cells
(2) potential gradients
(3) a condition of no current flow through the galvanometer
(4) a combination of cells, galvanometer and resistance
Sol^n: Same as taught directly in Theory Class of Electrical Circuits (Potentiometer)

Potentiometer (ideal voltmeter) works on Principle of Null Point, when no current flows through Galvanometer :.ANS: (3)

The given electrical network is equivalent to



(1) AND gate (2) OR gate (3) NOR gate (4) NOT gate

37. Sol^n: Same as that taught directly in Theory Class of Logical Gates (Electronics)

A	B	
0	1	0 -> 1 -> 0
1	0	0 -> 1 -> 0
1	1	0 -> 1 -> 0

Reverse of OR
Hence, NOR Gate

ANS: (3)

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38. In a common emitter transistor amplifier the audio signal voltage across the collector is 3V. The resistance of collector is 3 kΩ. If current gain is 100 and the base resistance is 2kΩ, the voltage and power gain of the amplifier is :
(1) 200 and 1000 (2) 15 and 200 (3) 150 and 15000 (4) 20 and 2000
Sol^n: Same as that taught directly in Theory Class of CE Amplifier (Electronics)

Voltage Gain, $A_V = \beta . R_C/R_{in} = 100 \times 3/2 = 150$
P_{avg} Gain = $A_V . B = 150 \times 100 = 15000$:.ANS: (3)

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39. Two discs of same moment of inertia rotating about their regular axis passing through centre and perpendicular to plane of disc with angular velocities ω_1 and ω_2.They are brought into contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is :
(1) $\frac{1}{2}(\omega_1 + \omega_2)^2$ (2) $\frac{1}{4}(\omega_1 - \omega_2)^2$ (3) $I(\omega_1 - \omega_2)^2$ (4) $\frac{1}{8}(\omega_1 - \omega_2)^2$
Sol^n: Same as that taught directly in Theory Class of Angular Momentum Conservation and Inelastic Collision Expression

$\Delta K = 1/2 . \mu . u^2_{rel} = 1/2 . (I . I)/(I + I) . (\omega_1 - \omega_2)^2 = I(\omega_1 - \omega_2)^2 / 4$:.ANS: (2)

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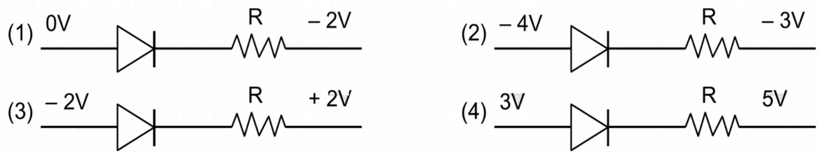
40. Young's double slit experiment is first performed in air and then in a medium other than air. It is found that 8^{th} bright fringe in the medium lies where 5^{th} dark fringe lies in air. The refractive index of the medium is nearly :

(1) 1.25 (2) 1.59 (3) 1.69 (4) 1.78

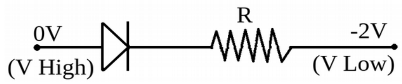
Sol^n: Same as that taught directly in Theory Class of YDSE (Interference of Light)

$\delta \cdot \lambda/\mu \cdot D/d = (4 + 1/2)\lambda D/d \Rightarrow \mu = 2 \times 8/9 = 16/9 = 1.78$:.ANS: (4)

Which one of the following represents forward bias diode?



41. Same as that taught directly in Theory Class of PN Junction FB Mode (Electronics)



:.ANS: (1)

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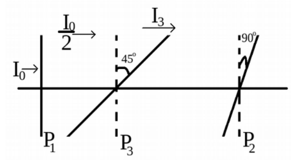
42. Two polaroids P_1 and P_2 are placed with their axis perpendicular to each other. Unpolarised light I_0 is incident on P_1. A third Polaroid P_3 is kept in between P_1 and P_2 such that its axis makes an angle 45° with that of P_1. The intensity of transmitted light though P_2 is :

(1) $I_0/2$ (2) $I_0/4$ (3) $I_0/8$ (4) $I_0/16$

Sol^n: Same as that taught directly in Theory Class of Polarisation of Light (Malus's Law)



$I_\theta = I_o . \cos^2\theta$

Through P_3 $I_3 = I_o/2 . \cos^2 45 = I_o/4$

Through P_2 $I_2 = I_o/4 . \cos^2 45 = I_o/4 . 1/2 = I_o/8$:.ANS: (3)

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43. In an electromagnetic wave in free space the root mean square value of the electric field is $E_{rms} = 6$V/m. The peak value of the magnetic field is :

(1) 1.41×10^{-8} T (2) 2.83×10^{-8} T (3) 0.70×10^{-8} T (4) 4.23×10^{-8} T

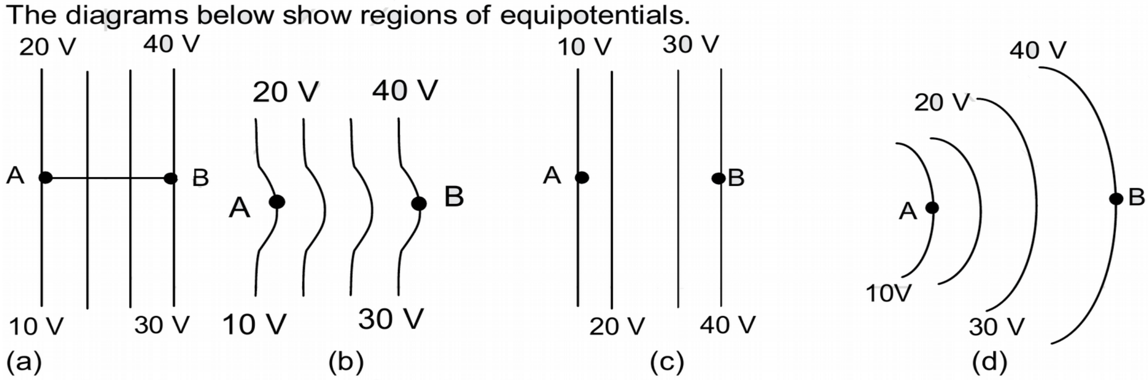
Sol^n: Same as that taught directly in Theory Class of E. M. Waves

$E_{rms} = 6$ V/m $\Rightarrow E_{rms}/B_{rms} = c$:.$B_{rms} = E_{rms} / c$

$\Rightarrow B_{peak} = B_m . \sqrt{2} = E_{rms} / c . \sqrt{2} = (6^2/3 \times 10) \times 1.414 = 2.828 \times 10^{-8}$ T :.ANS: (2)

45.

The diagrams below show regions of equipotentials.



(a) (b) (c) (d)

A positive charge is moved from A to B in each diagram

(1) Maximum work is required to move q in figure (c).

(2) In all the four cases the work done is the same.

(3) Minimum work is required to move q in figure (a)

(4) Maximum work is required to move q in figure (b).

Sol^n: Same as that taught directly in Theory Class of Electrostatics

$W_{agent} = \Delta U = q. \Delta V = q (V_f - V_i) = q (40 - 10)$

$= 30q$ (Joule), same in all figures :.ANS(2)

-These 41 Questions out of total 45 Questions were taught directly in classroom by Prof. Mukul Jha