BANSAL CLASSES
PRIVATE LIMITED
Ideal for Scholars

FACULTY SELECTION TEST

PHYSICS

Time: 90 Min. **Max. Marks: 200**

GENERAL INSTRUCTIONS

1. Write your Name in the Space Provided in the Bottom of this Booklet.

2. The question paper consists of **'50'** objective type questions.

3. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

4. Each correct answer carries **4 marks** and each wrong answer **(– 1) Mark**.

5. Use **Black or Blue Ball Point Pen** only for filling particulars.

6. Use of Blank Papers, Clip Boards, Calculator, Log Table, Slide Rule and Mobile or any electronic gadgets in any form is not allowed.

7. In case of any dispute, the answer filled in the OMR sheet available with the institute shall be final.

8. After completion submit the Question Paper back along with the Answer Sheet.

Name: _____

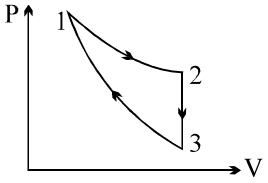
Q.1 A spectral line results from the transition n = 2 to n = 1 in the single electron system given below. Which one of these will produce the shortest wavelength emission ?

(1) H (2) He^{+} (3) Li^{++} (4) Dueterium atom

Q.2 A spherical black body with a radius of 12 cm radiates 450 W 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) 900 (4) 1800

Q.3 Three processes compose a thermodynamics cycle shown in the PV diagram. Process 1→2 takes place at constant temperature. Process 2→3 takes place at constant volume, and process 3→1 is adiabatic. During the complete cycle, the total amount of work done is 10 J. During process 2→3, the internal energy decrease by 20J and during process 3→1, 20 J of work is done on the system. How much heat is added to the system during process 1→2?

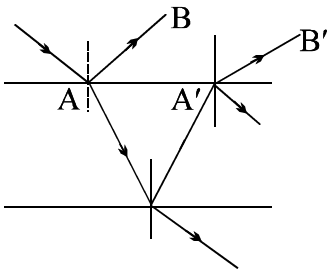


(1) 0 (2) 10 J (3) 20 J (4) 30 J

Q.4 A bi-concave glass lens having refractive index 1.5 has both surfaces of same radius of curvature R. On immersion in a medium of refractive index 1.75, it will behave as a

(1) convergent lens of focal length 3.5 R (2) convergent lens of focal length 3.0 R
(3) divergent lens of focal length 3.5 R (4) divergent lens of focal length 3.0 R

Q.5 A ray of light of intensity I is incident on a parallel glass-slab at a point A as shown in fig. It undergoes partial reflection and refraction. At each reflection 20% of incident energy is reflected. The rays AB and A′ B′ undergo interference. The ratio I_{max}/I_{min} is



(1) 4 : 1 (2) 49 : 1
(3) 7 : 1 (4) 81 : 1

Q.6 At room temperature, when white light is passed through a tube filled with atomic hydrogen all in ground state, then in absorption spectrum

(1) only Lyman series is missing (2) only Balmer series is missing
(3) neither Lyman nor Balmer series are missing (4) both Lyman and Balmer series are missing

SPACE FOR ROUGH WORK

Q.7 The half life of radioactive element X is 100 μs. The time taken for the radioactivity of a sample of X to decay to $\frac{1}{16}^{th}$ of its initial value is

(1) 400 μs (2) 6.3 μs (3) 40 μs (4) 300 μs

Q.8 Photons with energy 5 eV are incident on a cathode C, on a photoelectric cell. The maximum kinetic energy of the emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no photoelectrons will reach the anode A if the stopping potential of A relative to C is

(1) 3 V (2) – 3V (3) – 1V (4) 4 V

Q.9 In the Bohr model of the hydrogen atom, which of the following statement is not correct.

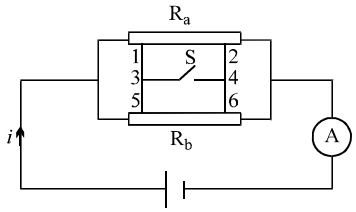
(1) the radius of the n^{th} orbit is proportional to n^2

(2) the total energy of the electron in n^{th} orbit is inversely proportional to n

(3) the angular momentum of the electron in an orbit is an integral multiple of $h/2\pi$.

(4) the magnitude of the potential energy of the electron in any orbit is greater than its kinetic energy.

Q.10 Two conductors 1-3-5 and 2-4-6 are connected at point with equal potential on the resistors R_a and R_b so that no current flows through either of them. If switch S is closed, then :



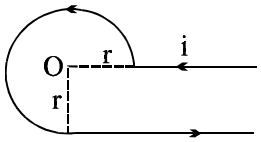
(1) no current will flow in section 3-4

(2) current will flow from 3-4 and ammeter reading will increase.

(3) current will flow from 3-4 and ammeter reading will decrease.

(4) current will flow from 3-4 and ammeter reading will be same as it was before S was closed.

Q.11 The magnetic induction at point O, if the current carrying wire is in the shape shown in the figure.



(1) $\frac{\mu_0 i}{4\pi r}\left[\frac{3}{2}\pi+1\right]$ (2) $\frac{\mu_0 i}{2\pi r}\left[\frac{3}{2}\pi+1\right]$ (3) $\frac{\mu_0 i}{\pi r}\ \frac{3}{2}$ (4) $\frac{\mu_0 i}{2\pi r}\left[1-\frac{3}{2}\pi\right]$

SPACE FOR ROUGH WORK

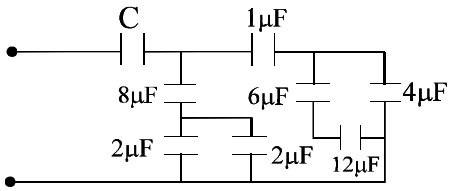
Q.12 An emf of 15 volt is applied in a circuit containing 5 H inductance and 10 Ω resistance. The ratio of the currents at time t = ∞ and t = 1 second is

(1) $\frac{\sqrt{e}}{\sqrt{e}-1}$ (2) $\frac{e^2}{e^2-1}$ (3) $1-e$ (4) e^{-1}

Q.13 The length of each side of a cubical closed surface is *l*. If charge q is situated on one of the vertices of the cube, then the flux passing through the cube will be :

(1) $\frac{q}{16\in_0}$ (2) $\frac{q}{12\in_0}$ (3) $\frac{q}{24\in_0}$ (4) $\frac{q}{8\in_0}$

Q.14 In the following circuit, the resultant capacitance between A and B is 1 μF. The value of C is

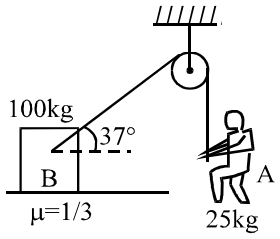


(1) $\frac{32}{11}$ μF (2) $\frac{11}{32}$ μF (3) $\frac{23}{32}$ μF (4) $\frac{32}{23}$ μF

Q.15 A gas contains only rigid diatomic molecules at temperature T. If I is the moment of inertia of the molecule, then root mean square angular velocity of the molecule is:

(1) $\sqrt{kT/I}$ (2) $\sqrt{3kT/I}$ (3) $\sqrt{5kT/I}$ (4) $\sqrt{2kT/I}$

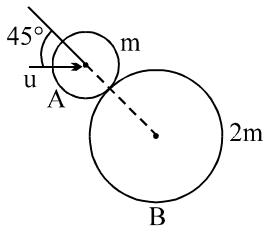
Q.16 Block B of mass 100 kg rests on a rough surface of friction coefficient μ = 1/3. A rope is tied to block B as shown in figure. The maximum acceleration with which boy A of 25 kg can climbs on rope without making block move is :



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

SPACE FOR ROUGH WORK

Q.17 Disc A of mass m collides with stationary disk B of mass 2m as shown in figure. The value of coefficient of restitution for which the two disks move in perpendicular direction after collision is (neglect friction):



(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{2\sqrt{2}}$

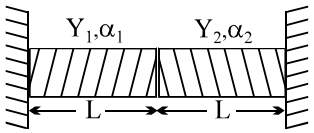
(3) $\frac{1}{2}$ (4) None of these

Q.18 10 gm of ice at –20°C is dropped into a calorimeter containing 10 gm of water at 10°C. The specific heat of water is twice that of ice. Neglect heat capacity of the calorimeter. When equilibrium is reached, the calorimeter will contain

(1) 10 gm ice and 10 gm of water (2) 20 gm of water

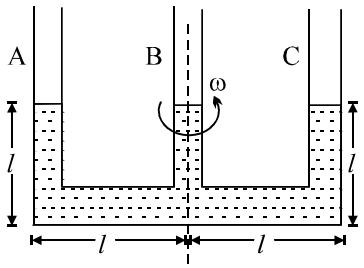
(3) 5 gm ice and 15 gm of water (4) 20 gm ice

Q.19 Two different rods of same length & same cross section area but made of different materials having coefficient of thermal expansion α_1 and α_2 and Young's modulus Y_1, Y_2 respectively are fixed between two rigid massive walls as shown. The rods are heated such that they undergo the same increase in temperature. There is no bending of the rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses developed in the two rods are equal provided $Y_1 : Y_2$:



(1) 2 : 3 (2) 1 : 1 (3) 3 : 2 (4) 4 : 9

Q.20 Figure shows a three arm tube in which a liquid is filled upto levels of height *l*. It is now rotated at an angular frequency ω about an axis passing through arm B. The angular frequency ω at which level of liquid in arm B becomes zero.



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

SPACE FOR ROUGH WORK

Q.21 Two point masses of mass $4m$ and m respectively separated by d distance are revolving under mutual force of attraction. Ratio of their kinetic energies will be :

(1) 1 : 4 (2) 1 : 5 (3) 1 : 1 (4) 1 : 2

Q.22 Five waveforms moving with equal speeds on the x-axis

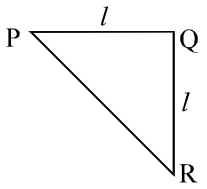
$y_1 = 8 \sin(\omega t + kx)$; $y_2 = 6 \sin(\omega t + \frac{\pi}{2} + kx)$; $y_3 = 4 \sin(\omega t + \pi + kx)$; $y_4 = 2 \sin(\omega t + \frac{3\pi}{2} + kx)$;

$y_5 = 4\sqrt{2} \sin(\omega t - kx + \frac{\pi}{4})$ are superimposed on each other. The resulting wave is :

(1) $8\sqrt{2} \cos kx \sin(\omega t + \frac{\pi}{4})$ (2) $8\sqrt{2} \sin(\omega t - kx + \frac{\pi}{4})$

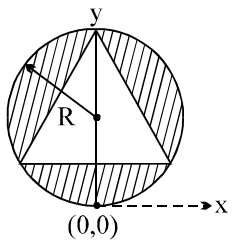
(3) $8\sqrt{2} \sin kx \cos(\omega t + \frac{\pi}{4})$ (4) $8 \sin(\omega t + kx)$

Q.23 In the triangular sheet given PQ = QR = l. If M is the mass of the sheet. What is the moment of inertial about PR



(1) $\frac{Ml^2}{24}$ (2) $\frac{Ml^2}{12}$ (3) $\frac{Ml^2}{6}$ (4) $\frac{Ml^2}{18}$

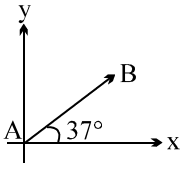
Q.24 From a uniform disc of radius R, an equilateral triangle of side $\sqrt{3}\,R$ is cut as shown. The new position of centre of mass is :



(1) (0, 0) (2) (0, R) (3) $(0, \frac{\sqrt{3}\,R}{2})$ (4) none of these

SPACE FOR ROUGH WORK

Q.25 A butterfly is flying with velocity $10\hat{i}+12\hat{j}$ m/s and wind is blowing along x axis with velocity u. If butterfly starts motion from A and after some time butterfly reaches point B. The value of u is:

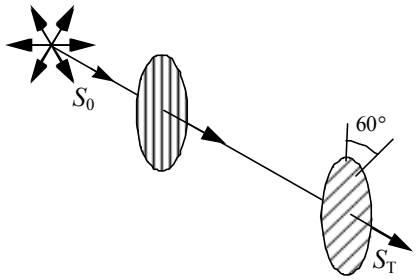


(1) 3 m/s (2) 5 m/s (3) 6 m/s (4) 2 m/s

Q.26. Light of wavelength 625 nm shines through a single slit of width 0.320 mm and forms a diffraction pattern on a flat screen located 8.00 m away. Determine the distance between the middle of the central bright fringe and the first dark fringe.

(1) 0.156 cm (2) 0.516 cm (3) 1.56 cm (4) 5.16 cm

Q.27 Unpolarized light of intensity S_0 passes through two sheets of polarizing material whose transmission axes make an angle of 60° with each other as shown in the figure. What is the intensity of the transmitted beam, S_T?



(1) $S_0/4$ (2) $S_0/8$ (3) $3\ S_0/4$ (4) $S_0/16$

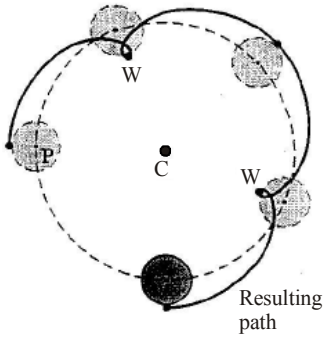
SPACE FOR ROUGH WORK

Q.28 The amplitude of the electric field component of an electromagnetic wave is increased from E to 4E. What is the corresponding change in the intensity of the wave?
(1) The intensity is unchanged by the increase in E.
(2) The intensity increases by a factor of sixteen.
(3) The intensity increases by a factor of four.
(4) The intensity decreases by a factor of four.

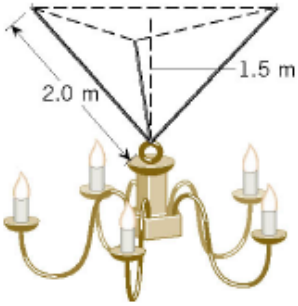
Q.29 A cellular telephone transmits electromagnetic waves at a frequency of 935 MHz. What is the wavelength of these waves?
(1) 0.0106 m (2) 0.321 m (3) 0.642 m (4) 2.40 m

Q.30 Which one of the following colors of visible light has the highest frequency?
(1) yellow (2) red (3) green (4) violet

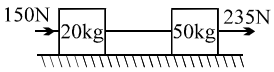
Q.31 In Figure, the motion of a spinning wheel (W) that itself revolves in a circle is shown. Which of the following would not be represented by this type of motion?
(1) A planet in orbit around the sun
(2) A ride at an amusement park
(3) A wheel rolling on another wheel
(4) A car going around a race track



Q.32 In Figure a 22.0 kg chandelier is supported by three identical, symmetrical, massless cables as shown. What is the vertical component of the tension in each cable?
(1) 22.0 N
(2) 36.2 N
(3) 71.9 N
(4) 109 N



Q.33 Two blocks of masses 20 kg and 50 kg are lying on a horizontal floor (coefficient of friction $\mu = 0.5$). Initially string is just taut and blocks are at rest. Now two forces 235 N and 150N is applied on two blocks as shown in figure. What is acceleration of 20 kg block ($g = 10\ m/s^2$)



(1) 0.5 m/s^2 (2) zero (3) 2.5 m/s^2 (4) cannot be determined

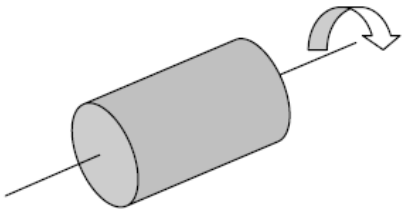
SPACE FOR ROUGH WORK

Q.34 A 1.0 kg lead ball is dropped from rest from 1.00 meter above a mini-trampoline. If the trampoline can be thought of as a spring with an elastic constant of 1000 N/m, how high will the ball ascend after bouncing off of the trampoline?
(1) 0.001 m (2) 0.01 m (3) 0.1 m (4) 1.0 m

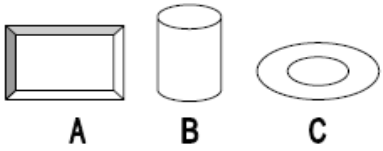
Q.35 A bat hits a ball, sending it off with a high speed. What changes would make the ball leave with the same velocity?
(1) Double the force, double the time interval (2) Halve the force, double the time interval
(3) Double the mass, halve the time interval (4) Double the mass, halve the force

Q.36 The wheels on the old-time bicycle shown in Figure have radii of 60.0 cm and 10.0 cm. If the larger wheel is rotating at 12.0 rad/ s, what is the angular speed of the smaller wheel?
(1) 10.0 rad/s (2) 12.0 rad/s
(3) 60.0 rad/s (4) 72.0 rad/s

Q.37 In Figure a 15.00 kg cylinder with a radius of 25.00 cm rotates at an angular speed of 500.00 RPM. If a 100.00 N braking force is applied normal to the curved surface of the cylinder brings it to rest in 15.00 s, what is the coefficient of kinetic friction between the brake and the cylinder?
(1) 0.027 (2) 0.042
(3) 0.066 (4) 0.140



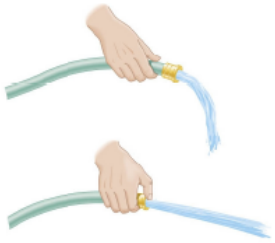
Q.38 Each of the objects in Figure rests 1.0 m beneath the surface of a calm pond. The objects are made of the same material and have the same mass. Which will experience the greatest buoyant force?
(1) A (2) B (3) C (4) None of the above



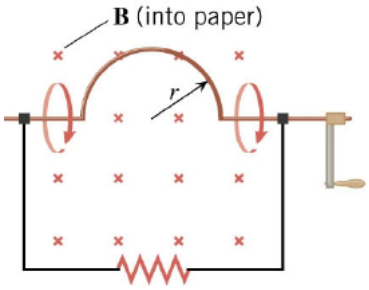
SPACE FOR ROUGH WORK

Q.39 Figure shows a man increasing the speed of water coming from a garden hose. This is done by

(1) the added pressure of the man's thumb.
(2) the angle change in the hose.
(3) the directionality of the water.
(4) the reduction in cross-section of the water's exit.



Q.40 The semicircular wire loop shown in Figure has a radius of 8.0 cm. The loop is rotated at 3.2 revolutions per second in a magnetic field of 0.4 T as shown in the figure. If the resistor has a value of 2.0 Ω what is the maximum current in the circuit?



(1) 80.9 mA (2) 40.4 mA

(3) 12.9 mA (4) 3.2 mA

Q.41 The half-life of a certain radioactive sample is 30 minutes. At 2.00 P.M. the decay rate is measured to be 1200/s. What will be the outcome of a measurement of the decay rate at 3:00 P.M. on that same day?

(1) 4800/s (2) 1200/s (3) 600/s (4) 300/s

Q.42 What is the momentum of a photon of red ($\lambda = 633$ nm) light?

(1) 3.13×10^{-19} kg.m/s (2) 6.33×10^{-21} kg.m/s
(3) 1.04×10^{-27} kg.m/s (4) 6.63×10^{-34} kg.m/s

Q.43 What is the deBroglie wavelength of an electron that has a speed of 10^4 m/s?

(1) 9.11×10^{-27} m (2) 7.25×10^{-17} m
(3) 9.11×10^{-11} m (4) 7.25×10^{-8} m

Q.44 An electromagnetic wave has an electric field with peak value 250 N/C. What is the average intensity of the wave?

(1) 0.66 W/m^2 (2) 0.89 W/m^2 (3) 83 W/m^2 (4) 120 W/m^2

Q.45 An organ pipe A closed at one end vibrating in its third harmonic and another pipe B opened at both ends vibrating in its third harmonic are in resonance with a given tunning fork. The ratio of length of A to that of B is: [Neglect end correction]

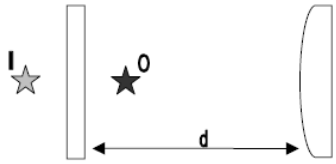
(1) $\frac{1}{2}$ (2) 2 (3) $\frac{1}{8}$ (4) 8

SPACE FOR ROUGH WORK

Q.46 Light emerges from a polarizer that has its transmission axis located along the x axis. The light then passes through two additional sheets of polarizing material. It is desired to orient the two sheets so that, after passing through both of them, the electromagnetic wave has the maximum possible intensity and is polarized 90° with respect to the x axis. How should the transmission axes of the sheets be oriented? Note: the following answers give the angles that the transmission axes make with respect to the x axis.

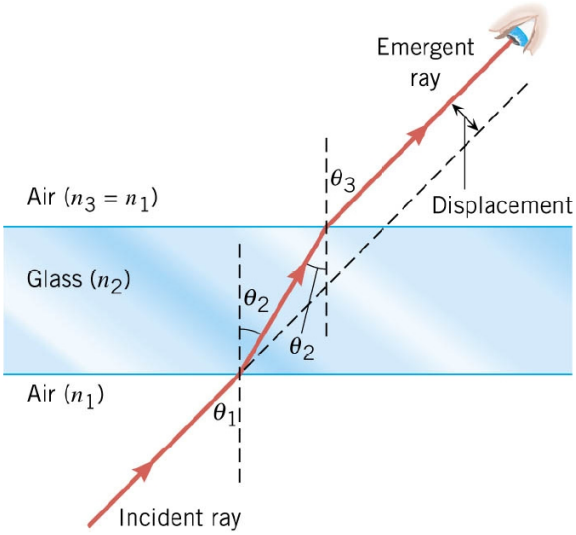
First polarizing sheet	Second polarizing sheet
(1) 45° with respect to the x axis	45° with respect to the x axis
(2) 45° with respect to the x axis	90° with respect to the x axis
(3) 90° with respect to the x axis	45° with respect to the x axis
(4) 30° with respect to the x axis	60° with respect to the x axis

Q.47 In Figure an object (marked O) is placed in front of a plane mirror. The plane mirror produces an image (marked I). A convex mirror that has a focal length of 25.0 cm is placed 100.0 cm away from the plane mirror, as shown. If the object is 5.0 cm away from the plane mirror, where does the convex mirror form an image of the reflection from the plane mirror?



(1) 35.0 cm to the left of the convex mirror (2) 33.9 cm to the left of the convex mirror
(3) 32.8 cm to the left of the convex mirror (4) 20.2 cm to the right of the convex mirror

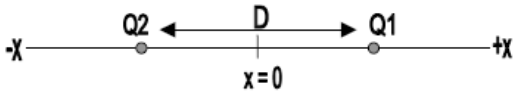
Q.48 The incident ray in Figure is displaced from its original path by the glass plate (n = 1.52) as shown. If the plate is 10.0 cm thick and $\theta_1 = 45°$, what is the magnitude of the displacement?



(1) 3.3 cm (2) 4.7 cm (3) 5.3 cm (4) 8.5 cm

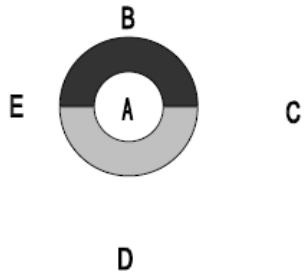
SPACE FOR ROUGH WORK

Q.49 In Figure, two charges, Q_1 and Q_2, are located on the x-axis at a distance D apart and equidistant from the origin, as shown. If the magnitude of Q_1 is greater than Q_2 and the charges are both negative, where might the electric field be zero?



(1) $x > +D$ (2) $x > +\frac{D}{2}$ (3) $-\frac{D}{2} < x < +\frac{D}{2}$ (4) $x < -\frac{D}{2}$

Q.50 In Figure a ring of charge is shown. The dark region has a uniform positive charge density; the light region has a uniform negative charge density. If there is less total positive charge, where might the electric field be zero?



(1) A (2) B
(3) C (4) D

SPACE FOR ROUGH WORK