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Third Term Test - Grade 13 - 2025

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Physics

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Two hours

Name / Index No:

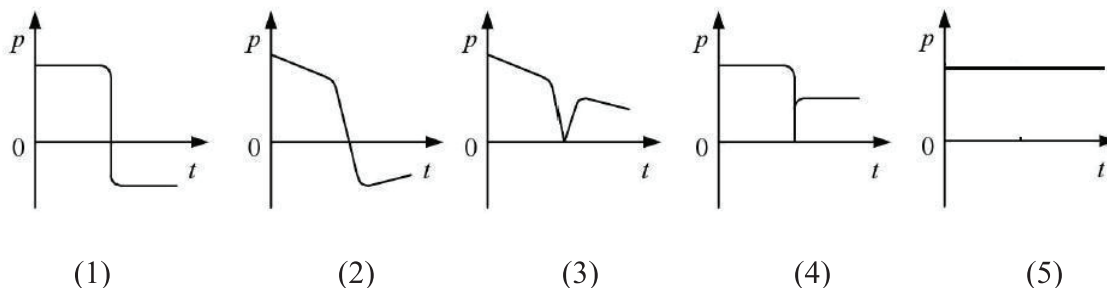
Instructions :

- These question papers consist of **50** questions in **10** pages.
- Answer **all** the questions.
- Write the index number in the space provided in the answer sheet.
- In each of the question from 1 to 50 pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct** or **most appropriate** and **mark your response on the answer sheet with a cross (x) on the number of the correct option in accordance with the instructions given on the back of the answer sheet.**

$$g = 10 \text{ N kg}^{-1}$$

- Consider $A = B^n C^m$, where A has dimensions LT , B has dimensions $L^2 T^{-1}$, and C has dimensions LT^2 . Then the exponent's n and m have the respective values:
 (1) $\frac{2}{3}; \frac{1}{3}$ (2) 2; 3 (3) $\frac{4}{5}; -\frac{1}{5}$ (4) $\frac{1}{5}; \frac{3}{5}$ (5) $\frac{1}{2}; \frac{1}{2}$
- Consider the following statements about the electrostatic induction.
 (A) Only insulators can be charged with electrostatic induction
 (B) When charge with electrostatic induction object must be grounded.
 (C) An object can be charged only as negative with electrostatic induction.
 Of the above statements
 (1) Only A is true. (2) Only B is true. (3) Only A and B are true
 (4) Only B and C are true (5) all A, B and C are **false**.
- Which of the following thermometer is highly sensitive for small change of temperature?
 (1) Mercury thermometer. (2) Clinical thermometer. (3) Thermo couple.
 (4) Gas thermometer. (5) Platinum resistance thermometer.
- Ultrasonic waves are those waves which
 (A) Human beings cannot hear
 (B) Have high velocity
 (C) Have high frequency
 Of the above statements,
 (1) Only (A) is correct (2) only (B) is correct (3) Only (A) and (B) are correct
 (4) only (A) and (C) are correct (5) All (A), (B) and (C) are correct

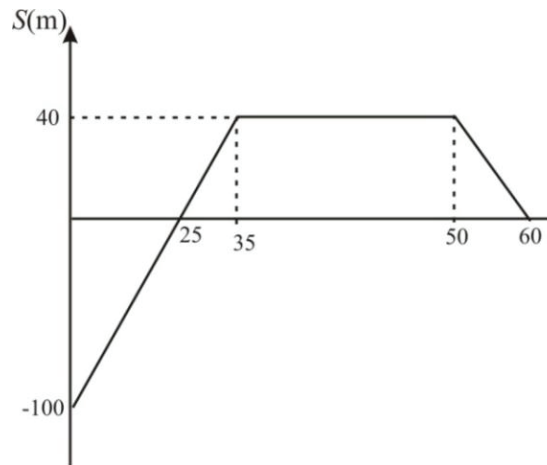
5. A stretched string of length 2 m resonates in 4 loops. The distance between consecutive nodes is
 (1) 0.5 m (2) 0.25 m (3) 1.0 m (4) 0.2 m (5) 0.3 m
6. Two identical objects have heat capacity in the ratio 1:2. When they are heated to the same temperature and allowed to cool freely, the initial ratio of rate of rate cooling is
 (1) 1:4 (2) 1: 3 (3) 1:2 (4) 2: 1 (5) 4:1
7. In which of the following/s would the application of the measuring instrument affect the physical quantity being measured?
 (A) Use a moving-coil voltmeter to measure the voltage across a resistor in a circuit
 (B) Use a mercury-in-glass thermometer to measure the temperature of small amount of warm water at the bottom of a test tube.
 (C) Use a spring balance to measure the weight of an object
 (1) (A) only (2) (C) only (3) (A) and (B) only
 (4) (B) and (C) only (5) All (A), (B) and (C)
8. A $10\ \Omega$ resistor has a constant current. If 1200 C of charge flows through it in 4 minutes what is the value of the current?
 (1) 3.0A (2) 5.0A (3) 11A (4) 15A (5) 20A
9. A disc is sliding across a horizontal, frictionless icy surface when it collides in-elastically with a wall at right angles to its path. Then it rebounds along its original path. Which of the following graphs shows the variation of the momentum p of the disc with time t ?



10. A long string is constructed by joining the ends of two shorter strings A and B . The tension in the strings is the same but string A has 4 times the linear density of string B . When a sinusoidal wave passes from string A to string B :
 (1) the frequency decreases by a factor of 2 (2) the frequency decreases by a factor of 4
 (3) the wavelength decreases by a factor of 2 (4) the wavelength decreases by a factor of 4
 (5) the wavelength increases by a factor of 2
11. The dew point of a closed room at $30\ ^\circ\text{C}$ is $25\ ^\circ\text{C}$. This room is then heated to $50\ ^\circ\text{C}$. If the room remain closed, the dew point of the room at $50\ ^\circ\text{C}$ is
 (1) $25\ ^\circ\text{C}$ (2) $30\ ^\circ\text{C}$ (3) $35\ ^\circ\text{C}$ (4) $40\ ^\circ\text{C}$ (5) $45\ ^\circ\text{C}$

12. The displacement of a particle changes in 60 s as shown in the figure. The distance travelled by the particle in this 60 s is

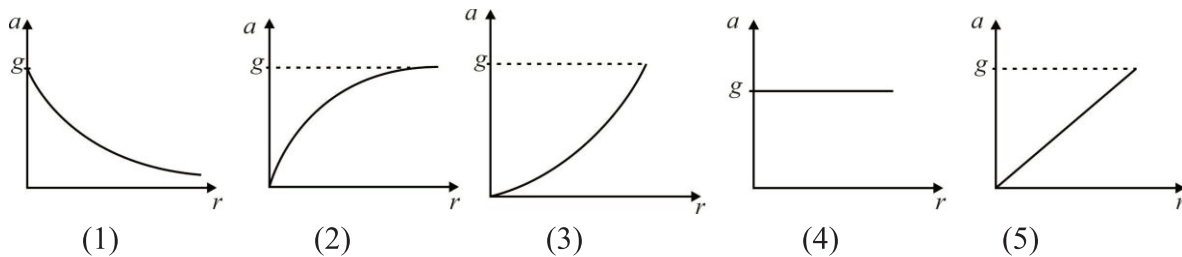
(1) 100 m (2) 180 m
(3) 200 m (4) 240 m
(5) 280 m



13. The fractional change in volume of a solid is 0.027 when heated from 0 °C to 10 °C. The lineal expansivity of the material is

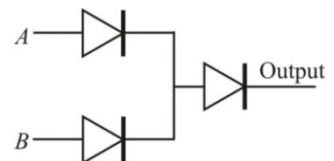
(1) 0.0027 °C⁻¹ (2) 0.0009 °C⁻¹ (3) 0.009 °C⁻¹ (4) 0.0003 °C⁻¹ (5) 0.003 °C⁻¹

14. Assume that the earth can be considered as a uniform sphere. Which of the followings graph represents the variation of acceleration due to gravity g from the center of the earth to the surface?



15. A and B in the given circuit represent two inputs of a logic gate. If zero volts and + 1 volts represent logic level 0 and 1 respectively, above logic circuit is (neglect knee voltage of diodes)

(1) an AND gate (2) an OR gate.
(3) a NAND gate. (4) a NOR gate.
(5) an EX-OR gate.

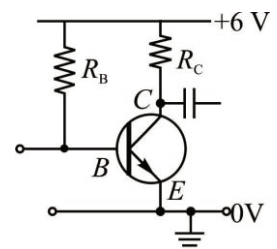


16. The intensity level at a place where intensity of sound is $4 \mu\text{W m}^{-2}$ (threshold intensity $10^{-12} \text{ W m}^{-2}$) ($\log 4 = 0.6020$)

(1) 5.339 dB (2) 6.602 dB (3) 53.392 dB (4) 66.02 dB (5) 76.02 dB

17. The figure shows a typical voltage-amplifier circuit built from a transistor with current gain 80. It operates normally on a collector current of 3 mA and with $V_{BE} = +0.6 \text{ V}$. What should be the value of the base resistor R_B ?

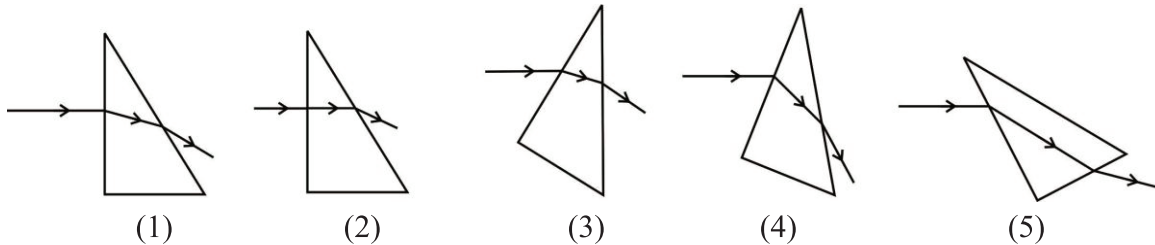
(1) 128 k Ω (2) 144 k Ω (3) 160 k Ω
(4) 176 k Ω (5) 184 k Ω



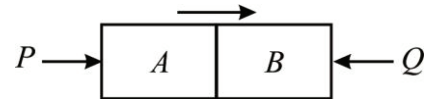
18. A wire of length 50 cm and cross sectional area 1 mm^2 is made of a material of Young's modulus $2 \times 10^{10} \text{ N m}^{-2}$. The work done in stretching the wire through 1 mm is

- (1) $2 \times 10^{-2} \text{ J}$ (2) $2 \times 10^{-3} \text{ J}$ (3) $1 \times 10^{-3} \text{ J}$ (4) $1 \times 10^{-2} \text{ J}$ (5) $1.5 \times 10^{-2} \text{ J}$

19. A monochromatic light ray is passing through a right angular glass prism as shown below. Identify the occasion where the deviation of the ray is minimum.

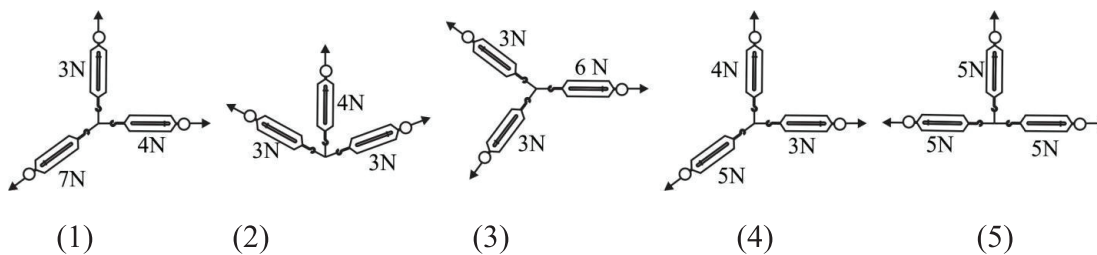


20. Two blocks A and B of mass ratio 1:2 are placed on a horizontal frictionless surface as shown above. P and Q are horizontal forces acting on A and B respectively (with $P > Q$) so that the blocks move to the right with constant acceleration. Find the force acting on B by A .

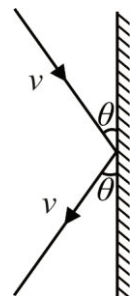


- (1) $\frac{P-Q}{3}$ (2) $\frac{P+Q}{3}$ (3) $\frac{2(P-Q)}{3}$ (4) $\frac{2P+Q}{3}$ (5) $\frac{P+2Q}{3}$

21. Three spring balances are joined to demonstrate a system of coplanar forces acting at a point. The magnitude of the forces is indicated at the balance. Which of the following system of forces could be in equilibrium?

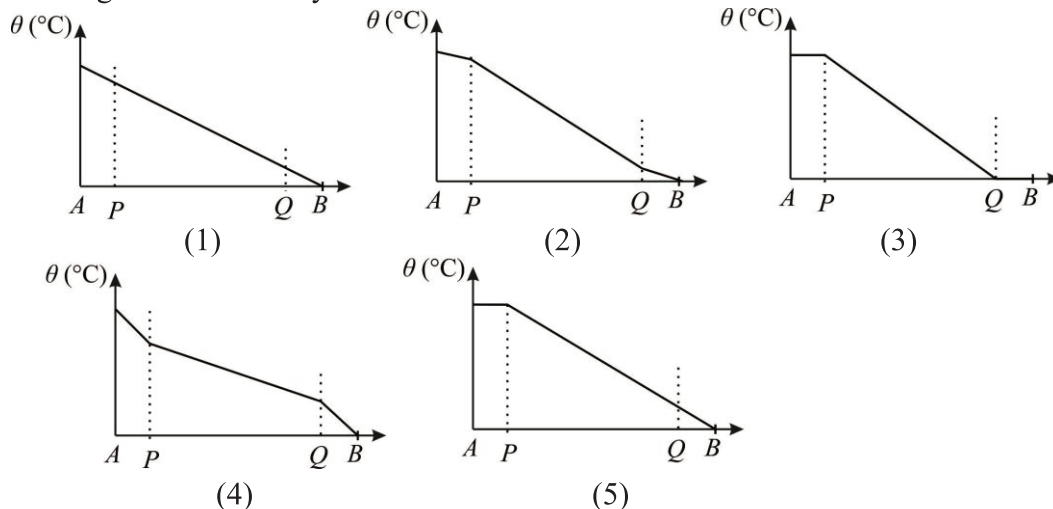
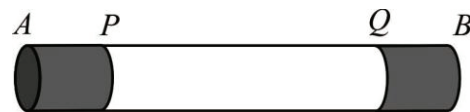


22. A gas atom of mass m moving with a uniform speed v makes an elastic collision with the wall of the container as shown in the diagram. What is the magnitude of the change in the momentum of the gas atom?



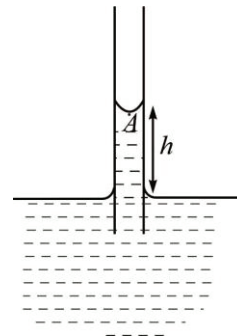
- (1) $2mv$ (2) $mv \sin \theta$ (3) $mv \cos \theta$
(4) $2mv \sin \theta$ (5) $2mv \cos \theta$

23. PQ is a metal bar with thin layers of glass AP and QB attached to each end. The whole system is well-lagged except cross sections at A and B . A is maintained at 100°C and B at 0°C . Which of the graphs below best represents the variation of temperature θ along AB at the steady state?



24. A liquid, of density ρ rises up a capillary tube of radius r to a height h . If the surface tension is T , then the pressure at A is (P is the atmospheric pressure)

- (1) $P - \rho gh$. (2) P . (3) $P + \rho gh$.
 (4) $P + \rho gh - \frac{2T}{r}$ (5) $P + \rho gh + \frac{2T}{r}$



25. A certain object floats in fluids of density

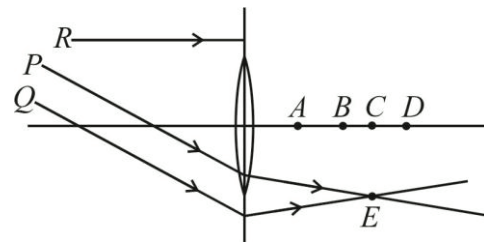
- (A) $0.9\rho_0$
 (B) ρ_0
 (C) $1.1\rho_0$

Which of the following statements is true?

- (1) the buoyant force of fluid (A) is greater than the buoyant forces of the other two fluids.
 (2) the buoyant force of fluid (C) is greater than the buoyant forces of the other two fluids.
 (3) the three fluids exert the same buoyant force.
 (4) the object displaces the same volume of all three fluids.
 (5) none of these are true.
26. What should be the angle of projection, so that the horizontal range of a projectile is equal to the maximum height?
 (1) $\tan^{-1} 4$ (2) $\tan^{-1} 2$ (3) $\tan^{-1} 1$ (4) $\tan^{-1} 3$ (5) none of the above
27. A trolley of mass 0.5 kg moves with a certain acceleration down a runway which is inclined to the horizontal at 15° . If the angle of inclination is increased to 20° , the acceleration of the trolley would be doubled. The average resistive force, assuming the same in both cases, acting on the trolley would be (nearly). ($\sin 15^\circ = 0.2588$, $\sin 20^\circ = 0.3420$)
 (1) 0.72 N (2) 0.80 N (3) 0.88 N (4) 0.96 N (5) 1.04 N

28. The diagram shows two incoming parallel rays of light P and Q which pass through a thin converging lens. The ray R which is parallel to the principle axis after passing through the lens will pass through the point

(1) A (2) B (3) C
(4) D (5) E



29. A charged particle enters a region of uniform magnetic field whose direction is normal to the plane of the paper. Initially the particle is moving in the plane of the paper. The subsequent path of the particle is as shown.

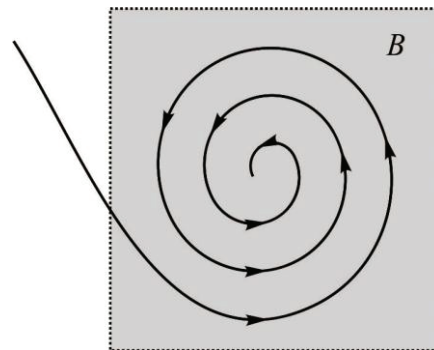
Which of the following is/are possible explanations to account for the shape of the path?

(A) The flux density of the magnetic field has decreased gradually.

(B) The charged particle has lost its charge gradually.

(C) The charged particle has lost its kinetic energy gradually.

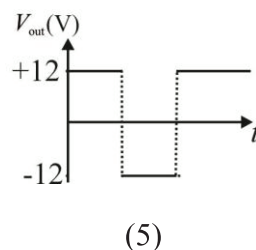
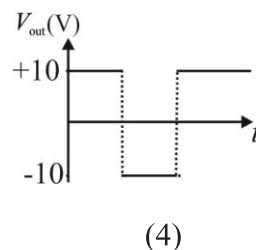
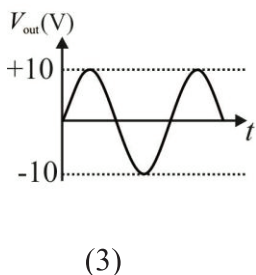
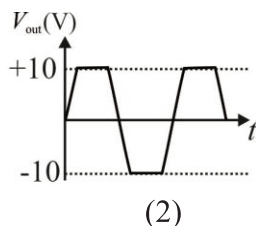
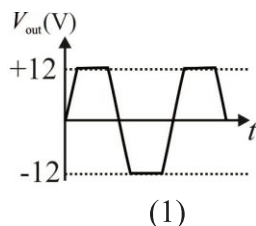
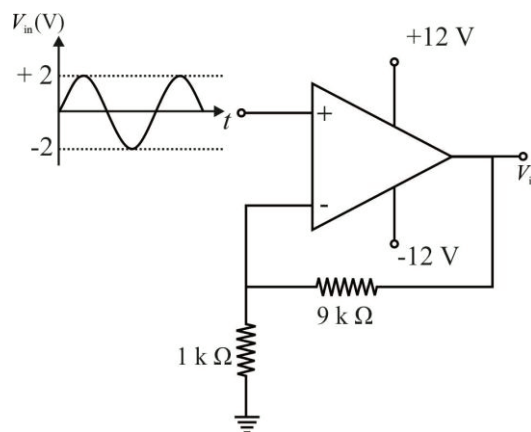
(1) (A) only (2) (C) only (3) (A) and (B) only
(4) (B) and (C) only (5) all (A), (B) and (C) are false.



30. If a nucleus has mass M , with L protons (each of mass m_p), and N neutrons (each of mass m_n), its binding energy is equal to:

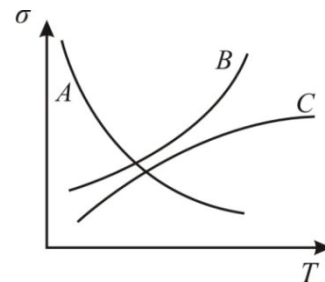
(1) $(Lm_p + Nm_n - M)c^2$ (2) Mc^2 (3) $(M - Lm_p - Nm_n)c^2$
(4) $(Lm_p - M)c^2$ (5) $(Lm_p + Nm_n)c^2$

31. A sinusoidal voltage of peak 2 V is given to the input of the op-amp shown in the figure. Consider that the output saturated voltage as ± 10 V. Then the output voltage variation would be 3



32. Two objects A and B of masses m and $2m$ respectively are initially at rest on a smooth, horizontal surface. If each of them is acted upon by the same force for the same period of time, the ratio of the gain in kinetic energy of A to that of B is
- (1) 2:1 (2) 1:2 (3) 1:1 (4) 1:4 (5) 4:1

33. Which of the following curves represent the variation of conductivity σ with temperature T of an intrinsic semiconductor and an insulator respectively?
- (1) C and B (2) A and B (3) B and C
 (4) C and A (5) A and C



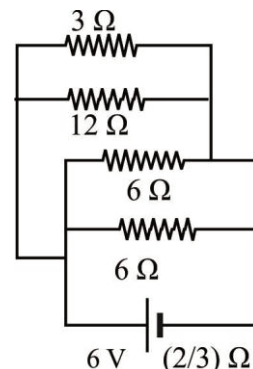
34. The ratio of turns of secondary and primary coils in a transformer is 3:2. If the power output is P then the input power, neglecting all losses, must be equal to
- (1) $5P$ (2) $\frac{3}{5}P$ (3) $\frac{2}{5}P$ (4) $1.5P$ (5) P
35. X and Y are two planets. Each of them has a low-altitude satellite revolving in a circular orbit close to the planet. If the two satellites are observed to have the same period, then X and Y must have nearly the same
- (1) Mass.
 (2) Average density.
 (3) Radius.
 (4) Acceleration due to gravity at the planet's surface.
 (5) Gravitational potential at the planet's surface.

36. A particle is constrained to move along the x axis under the influence of the net force $F = -kx$ where k is a positive constant. The amplitude of motion is A and the frequency is f . The speed of the particle when $x = A/2$ is
- (1) $2\pi fA$ (2) $\sqrt{3}\pi fA$ (3) $\sqrt{2}\pi fA$ (4) πfA (5) $\frac{1}{3}\pi fA$

37. A person suffering from myopia (short-sightedness) uses a lens of focal length 150 cm to observe far. If his near point is at 25 cm, then the shortest distance he can observe with the lens is
- (1) 20 cm (2) 25 cm (3) 30 cm (4) 35 cm (5) 40 cm

38. The cell shown in the figure has an EMF of 6 V and internal resistance $\frac{2}{3}\Omega$. The current through 12Ω resistor is

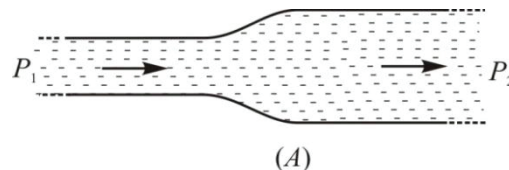
- (1) $\frac{1}{3}$ A (2) $\frac{2}{3}$ A (3) 1 A
 (4) $\frac{4}{3}$ A (5) 3 A



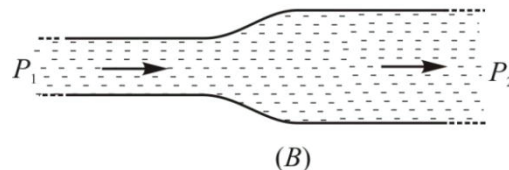
39. The angle of a prism is 30° . The ray incident at 60° at one refracting face suffers a deviation of 30° when passing through the prism. The angle of emergence at the second refracting surface is

- (1) 0° (2) 30° (3) 45° (4) 60° (5) 90°

40. *A* and *B* of figure shows two tubes which contain a steady flow of a liquid in to the direction shown with arrows. P_1 and P_2 indicate pressure at given ends. Which of the following is possible if *A* contains an ideal fluid and *B* contains a viscous fluid?



(A)



(B)

- | <i>A</i> | <i>B</i> |
|-----------------|-------------|
| (1) $P_1 = P_2$ | $P_1 = P_2$ |
| (2) $P_1 > P_2$ | $P_1 > P_2$ |
| (3) $P_1 < P_2$ | $P_1 < P_2$ |
| (4) $P_1 > P_2$ | $P_1 < P_2$ |
| (5) $P_1 < P_2$ | $P_1 > P_2$ |

41. The minimum wavelength of the X-rays emitted from a X-ray tube is controlled by

- (1) The cathode temperature. (2) The nature of the target.
 (3) The anode-cathode voltage. (4) The size of the target.
 (5) The length of the X-ray tube.

42. Consider the following statements on an ideal gass

- (A) for a constant pressure process $\Delta Q = \Delta U$.
 (B) for an isothermal compression $\Delta U > 0$
 (C) adiabatic process always must be quick.

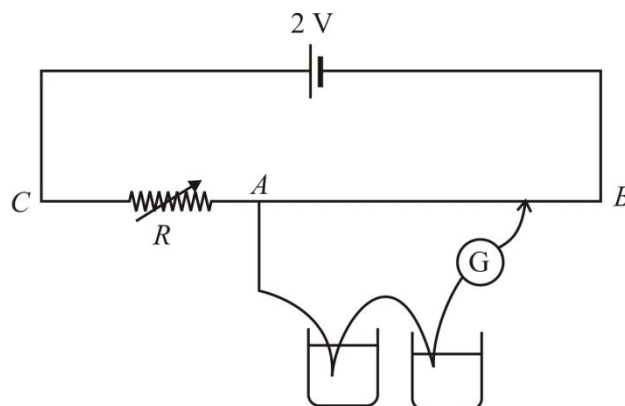
Which of the above statement is **incorrect**?

- (1) Only (A) (2) Only (C) (3) Only (A) and (C)
 (4) Only (A) and (B) (5) All (A), (B) and (C)

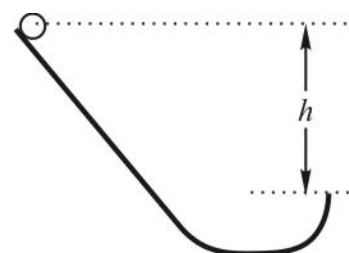
43. A spacecraft of mass 4.0×10^4 kg was travelling on its way to the moon with the rocket motors shut down. At the instant when it was travelling at constant 1500 m s^{-1} , the rocket motors were turned on for 5 seconds to make a course correction. If the rocket gave a thrust of 1.0×10^5 N at right angles to the direction of travel, through what angle would the flight path of the spacecraft be turned?

- (1) $1.6 \times 10^{-3} \text{ rad}$ (2) $5.7 \times 10^{-3} \text{ rad}$ (3) $8.3 \times 10^{-3} \text{ rad}$
 (4) $1.6 \times 10^{-2} \text{ rad}$ (5) $8.3 \times 10^{-2} \text{ rad}$

44. A thermo couple is connected to a potentiometer as shown in the figure. The primary power supply voltage of the potentiometer is 2 V and the length of the potentiometer wire AB is 1 m. The resistance of the potentiometer wire is $5\ \Omega$. When the thermocouple voltage is 6 mV the balance length is found to be 0.6 m. the magnitude of the resistor R is
- (1) $95\ \Omega$ (2) $195\ \Omega$ (3) $495\ \Omega$
 (4) $995\ \Omega$ (5) $1995\ \Omega$

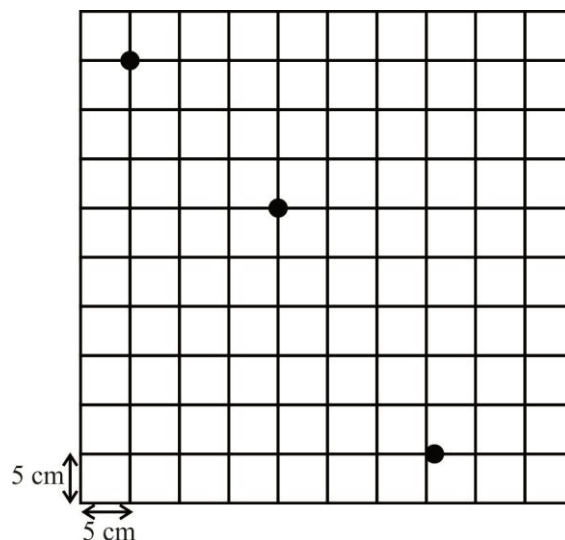


45. A ball of mass M and radius R has a moment of inertia of $I = \frac{2}{5}MR^2$. The ball is released from rest and rolls down the ramp with no frictional loss of energy. The ball is projected vertically upward off the ramp as shown in the diagram; the maximum height of the projectile in terms of h .



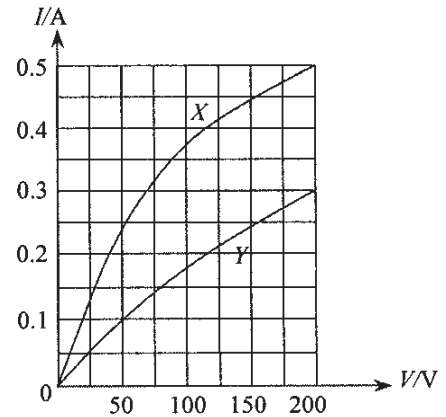
- (1) h (2) $\frac{25}{49}h$ (3) $\frac{2}{5}h$ (4) $\frac{5}{7}h$ (5) $\frac{7}{5}h$

46. The figure shows part of the stroboscopic picture of a particle initially projected horizontally into the air. The side of each square of the grid is 5 cm long. Estimate the frequency of the strobe lamp used. (Neglect air resistance.)
- (1) 5.8 Hz (2) 7.1 Hz
 (3) 10.0 Hz (4) 12.5 Hz
 (5) 15.0 Hz



47. In which of the following calculations is it necessary to use the Planck constant?
- (A) Finding the momentum of an electron from its kinetic energy
 (B) Finding the energy of a photon emitted as a result of the transition of an electron between two energy levels in an atom
 (C) Finding the maximum kinetic energy of photoelectrons from the wavelength of incident radiation
- (1) (A) only (2) (C) only (3) (A) and (B) only
 (4) (B) and (C) only (5) All (A),(B) and (C)

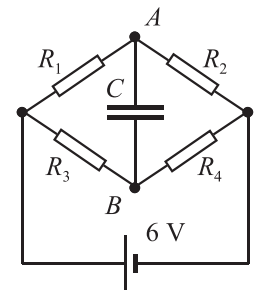
48. The graph shows the I - V characteristic of two light bulbs X and Y , which are marked respectively as '200 V, 100 W' and '200 V, 60 W'. If X and Y are connected in series to a 200 V mains supply, what is the approximate power dissipated in each bulb?



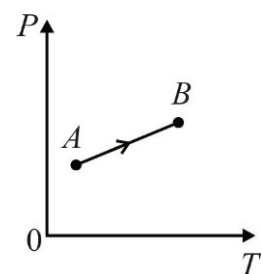
X	Y
(1) 12 W	36 W
(2) 15 W	25 W
(3) 40 W	20 W
(4) 50 W	30 W
(5) 50 W	20 W

49. In the above circuit, the cell has an e.m.f. 6 V and negligible internal resistance. The resistances of the four resistors R_1 , R_2 , R_3 and R_4 are $6\ \Omega$, $3\ \Omega$, $1\ \Omega$ and $2\ \Omega$ respectively. The capacitor has capacitance $20\ \mu\text{F}$. At steady state, the charge on the capacitor plate connecting to A is

- (1) $+40\ \mu\text{C}$ (2) $+80\ \mu\text{C}$ (3) $0\ \mu\text{C}$
 (4) $-80\ \mu\text{C}$ (5) $-40\ \mu\text{C}$



50. The graph shows the relation between the pressure P and the absolute temperature T of a fixed mass of an ideal gas, which changes from state A to state B along the path AB . Which of the following statements is/are correct?



- (A) The graph shows that P is directly proportional to T .
 (B) The volume V of the gas increases.
 (C) All the points on straight line AB satisfy the relation $\frac{PV}{T} = \text{constant}$.

- (1) (A) only (2) (C) only (3) (A) and (B) only
 (4) (B) and (C) only (5) All (A), (B) and (C)