PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 59

Total Marks : 26

Max. Time : 26 min.

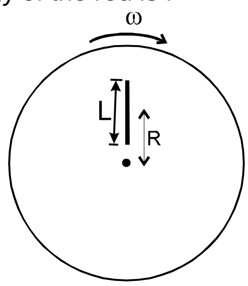
Topics : Elasticity, Work, Power and Energy, Rotation, Heat, Current Electricity

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4 to Q.5	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. A steel rod (Young's modulus = 2×10^{-11} Nm^{-2}) has an area of corss-section 3×10^{-4} m^2 and length 1 m. A force of 6 x 10 N stretches it axially. The elongation of the rod is
(A) 10^{-4} m (B) 5×10^{-3} m (C) 10^{-3} m (D) 5×10^{-2} m

2. Which of the following statement is not true?
(A) Work done by conservative force on an object depends only on the initial and final states and not on the path taken.
(B) The change in the potential energy of a system corresponding to conservative internal forces is equal to negative of the work done by these forces.
(C) If some of the internal forces within a system are non-conservative, then the mechanical energy of the system is not constant.
(D) If the internal forces are conservative, the work done by the internal forces is equal to the change in mechanical energy.

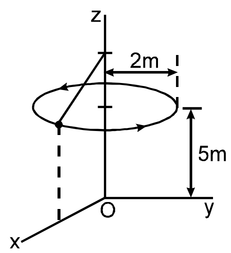
3. A uniform rod of mass m and length L lies radially on a disc rotating with angular speed ω in a horizontal plane about its axis. The rod does not slip on the disc and the centre of the rod is at a distance R from the centre of the disc. Then the kinetic energy of the rod is :



(A) $\frac{1}{2} m\omega^2 \left(R^2 + \frac{L^2}{12}\right)$ (B) $\frac{1}{2} m\omega^2 R^2$ (C) $\frac{1}{24} m\omega^2 L^2$ (D) None of these

4. The upper end of the string of a simple pendulum is fixed to a vertical z-axis and set in motion such that the bob moves along a horizontal circular path of radius 2 m, parallel to the xy plane, 5 m above the origin. The bob has a speed of 3 m/s. The string breaks when the bob is vertically above the x-axis, and it lands on the xy plane at a point (x, y)

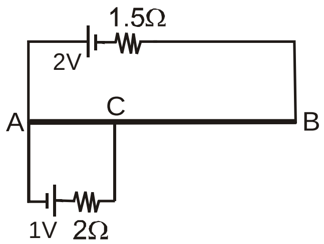
(A) x = 2 m (B) x > 2 m
(C) y = 3 m (D) y = 5 m



5. The rate of heat energy emitted by a body at an instant depends upon
(A) area of the surface
(B) difference of temperature between the surface and its surroundings
(C) nature of the surface
(D) None of these

COMPREHENSION

AB is a uniform wire of length 70 cm and resistance 7Ω. Part AC is 20 cm long.Two resistors and two ideal cells are connected as shown.



6. Potential gradient of the part CB of the wire is :

(A) 2.5V/m (B) 2V/m

(C) $\frac{10}{3}$V/m (D) 7.5V/m

7. Potential gradient of the part AC is :

(A) $\frac{5}{6}$V/m (B) 2V/m

(C) 5 V/m (D) 7.5V/m

8. Of the points A, B and C the potential is maximum at point:

(A) A (B) B

(C) C (D) same at all of these three points

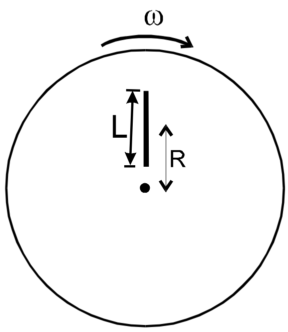
Answers Key

1.	(C)	**2.**	(D)	**3.**	(A)	**4.**	(A) (C)
5.	(A) (C)	**6.**	(C)	**7**.	(A)	**8.**	(C)

Hints & Solutions

3. **(A)** Moment of inertia of the rod w.r.t. the axis through centre of the disc is : (by parallel axis theorum).

$$I = \frac{mL^2}{12} + mR^2$$



& K.E. of rod w.r.t. disc

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

$$= \frac{1}{2} m\omega^2 \left[R^2 + \frac{L^2}{12}\right]$$ **Ans.**

5. Since, Heat energy radiated per sec = $Ae\sigma T^4$
where, e is emissivity of the surface which depends upon its nature and A is its area.
T is its own temperature (independent of surrounding temperature)
Hence, (A) and (C) are correct.

8. Let $V_A = 0$ volts.
$\because$ Net current entering node C = 0

$$\therefore \frac{0 - V_c}{2} + \frac{-2 - V_c}{6.5} + \frac{1 - V_c}{2} = 0$$

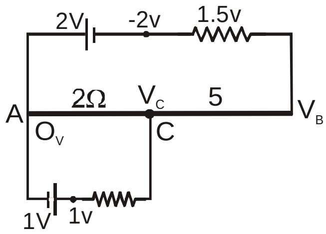
$$\therefore V_C = \frac{1}{6} \text{volt.} = \text{p.d across wire AC.}$$

Also $\frac{V_C - V_B}{5} = \frac{V_B + 2}{1.5} = \frac{V_C + 2}{6.5} = \frac{1}{3}$

$$\therefore V_C - V_B = \frac{5}{3} = \text{p.d. across wire BC}$$

$$\therefore V_C > V_B > V_A$$

Hence potential gradient across BC =



$$\frac{5/3}{1/2} = \frac{10}{3} \text{ V/m}$$

also potential gradient across

AC $\frac{1/6}{1/5} = \frac{5}{6}$ V/m