PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 64

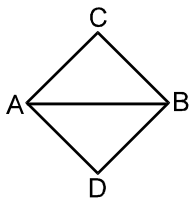
Total Marks : 26

Max. Time : 28 min.

Topics : Heat, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, Current Electricity, Center of Mass

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.4 to Q.5	(4 marks, 5 min.)	[8, 10]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. Two identical rectangular rods of metal are welded end to end in series between temperature 0°C and 100°C and 10 J of heat is conducted (in steady state process) through the rod in 2.00 min. If 5 such rods are taken and joined as shown in figure maintaining the same temperature difference between A and B, then the time in which 20 J heat will flow through the rods is :



(A) 30 sec. (B) 2 min. (C) 1 min. (D) 20 sec.

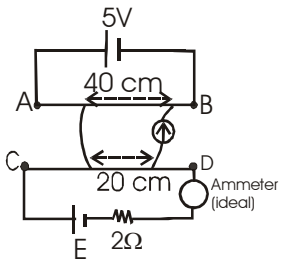
2. An α particle is moving along a circle of radius R with a constant angular velocity ω. Point A lies in the same plane at a distance 2R from the centre. Point A records magnetic field produced by α particle. If the minimum time interval between two successive times at which A records zero magnetic field is 't', the angular speed ω, in terms of t is -

(A) $\frac{2\pi}{t}$ (B) $\frac{2\pi}{3t}$ (C) $\frac{\pi}{3t}$ (D) $\frac{\pi}{t}$

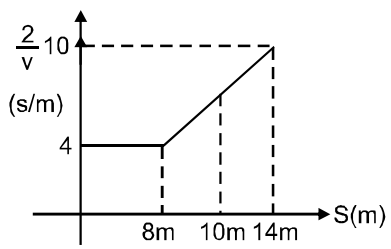
3. When a person throws a meter stick it is found that the centre of the stick is moving with speed 10 m/s and left end of stick with speed 20 m/s. Both points move vertically upwards at that moment. Then angular speed of the stick is:

(A) 20 rad/ sec (B) 10 rad/sec (C) 30 rad/sec (D) none of these

4. AB and CD are two uniform resistance wires of lengths 100 cm and 80 cm respectively . The connections are shown in the figure. The cell of emf 5 V is ideal while the other cell of emf E has internal resistance 2 Ω.A length of 20 cm of wire CD is balanced by 40 cm of wire AB. Find the emf E in volt, if the reading of the ideal ammeter is 2 A. The other connecting wires have negligible resistance.

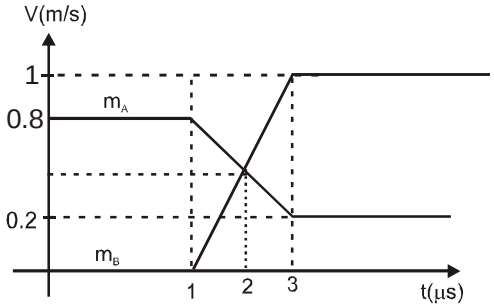


5. Figure shows $\frac{2}{v}$ v/s s curve for a particle of mass 2 kg moving in a straight line. If the time (in seconds) taken by the particle to achive a displacement of 10 m is t. (v = velocity, s = displacement), then find the value of (t – 20).



COMPREHENSION

There are two blocks A and B placed on a smooth surface. Block A has mass 10 kg and it is moving with velocity 0.8 m/s towards stationary B of unknown mass. At the time of collision, their velocities are given by the following graph :



6. Coefficient of restitution of the collision is
(A) 1.5 (B) 1 (C) 0.5 (D) 0.8

7. Impulse of deformation is :
(A) 1 Ns (B) 3 Ns (C) 6 Ns (D) 5 Ns

8. Maximum deformation potential energy is:
(A) 1.2 J (B) 3.2 J (C) 2.0 J (D) 1.6 J

Answers Key

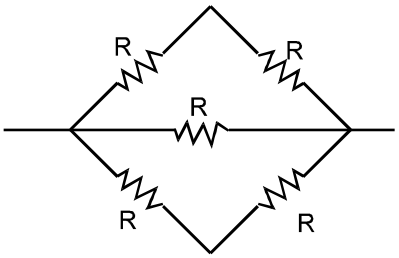
1.	(C)	**2.**	(B)	**3.**	(A)	**4.**	12
5.	1	**6.**	(B)	**7.**	(B)	**8.**	(A)

Hints & Solutions

1. $\frac{dQ}{dt} = \frac{KA\Delta T}{2\ell} = \frac{\Delta T}{\frac{2\ell}{KA}} = \frac{10}{120}$ J /sec.

New rate $\frac{d\dot{Q}}{dt} = \frac{\Delta T}{\frac{\ell}{2KA}}$

$= \frac{40}{120}$ J /sec. ;

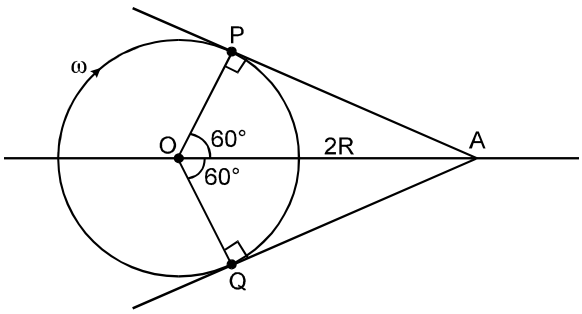


So time taken is t = $\frac{20}{40}$ × 120 sec.

= 60 sec.

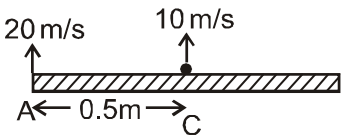
2. **(B)**

Point A shall record zero magnetic field (due to α-particle) when the α-particle is at position P and Q as shown in figure. The time taken by α-particle to go from P to Q is



$t = \frac{1}{3}\ \frac{2\pi}{\omega}$ or $\omega = \frac{2\pi}{3t}$

3. Angular velocity $w = \frac{20-10}{0.5} = 20$ rad/sec.



4. Potential difference across wire AB = 5 V

$\therefore$ p.d. across 40 cm of this wire

$= \frac{5}{100} \times 40 = 2$ volt.

$\therefore$ Potential difference across 20 cm of wire CD = 2 volt.

$\therefore$ p.d. across wire CD $= \frac{2}{20} \times 80 = 8$ volt.

p.d. across 2 Ω resistor $= 2 \times 2 = 4$ volt

$\therefore$ Emf of the cell = 12 volt.

5. $\int \frac{2}{v} ds = \int \frac{2}{ds} dt\, ds = 2t = 8 \times 4 + \frac{1}{2} \times 10 \times 2$

$t = 21$ s

$t - 20 = 1$ s **Ans.**

Sol. **(1 to 3)**

$m_A \times 0.8 = m_A \times 0.2 + m_B \times 1.0$

$m_A \times 0.6 \quad m_B \times 1.0 \quad m_B = 0.6\, m_A$

$e = \frac{1 - 0.2}{0.8} = 1 \quad = 1.5$

$I_d = 6 \times 0.5 - 6 \times 0 = 3N - 5$

$= 10 \times \{0.8 - 0.5\} \quad = 10 \times 0.3$

$= 3$ NS

$\Delta U = \frac{1}{2} \times 10 \times (0.8)^2 - \frac{1}{2} \times 10 \times (0.5)^2$

$= 5 \times 0.64 \quad 8 \times 0.25 = 3.2 - 2.0 = 1.2$ J