PHYSICS

DPP
DAILY PRACTICE PROBLEMS

DPP No. 49

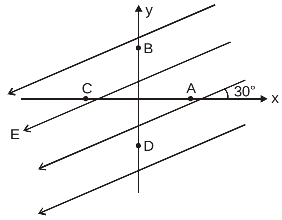
Total Marks : 25

Max. Time : 26 min.

Topics : Electrostatics, Kinematics, Current Electrisity, Center of Mass, Newton's Law of Motion

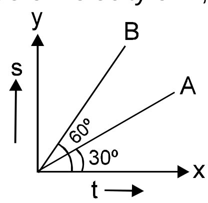
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.5	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. There exists a uniform electric field in the space as shown. Four points A, B, C and D are marked which are equidistant from the origin. If V_A, V_B, V_C and V_D are their potentials respectively, then



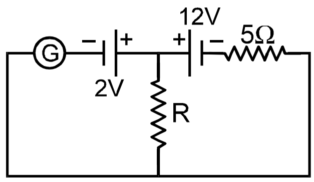
(A) $V_B > V_A > V_C > V_D$
(B) $V_A > V_B > V_D > V_C$
(C) $V_A = V_B > V_C = V_D$
(D) $V_B > V_C > V_A > V_D$

2. The displacement time graphs of two bodies A and B are shown in figure. The ratio of velocity of A, v_A to velocity of B, v_B is :



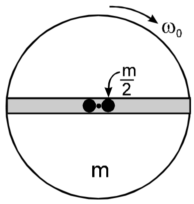
(A) $\frac{1}{\sqrt{3}}$
(B) $\sqrt{3}$
(C) $\frac{1}{3}$
(D) 3

3. In the circuit shown, the galvanometer shows zero current. The value of resistance R is :



(A) 1 Ω
(B) 2 Ω
(C) 4 Ω
(D) 9 Ω

4. A disc of mass 'm' and radius R is free to rotate in horizontal plane about a vertical smooth fixed axis passing through its centre. There is a smooth groove along the diameter of the disc and two small balls of mass $\frac{m}{2}$ each are placed in it on either side of the centre of the disc as shown in fig. The disc is given initial angular velocity ω_0 and released. The angular speed of the disc when the balls reach the end of disc is :



(A) $\frac{\omega_0}{2}$
(B) $\frac{\omega_0}{3}$
(C) $\frac{2\omega_0}{3}$
(D) $\frac{\omega_0}{4}$

5. A small block A is placed on a smooth inclined wedge B which is placed on a horizontal smooth surface. B is fixed and A is released from top of B. A slide down along the incline and reaches bottom in time t_1. In second case A is released from top of B, but B is also free to move on horizontal surface. The block A takes t_2 time to reach bottom. Without actually calculating the values of t_1 and t_2 find which is greater.

COMPREHENSION

A car battery with a 12 V emf and an internal resistance of 0.04 Ω is being charged with a current of 50 A.

6. The potential difference V across the terminals of the battery are
(A) 10 V (B) 12 V (C) 14 V (D) 16 V

7. The rate at which energy is being dissipated as heat inside the battery is :
(A) 100 W (B) 500 W (C) 600 W (D) 700 W

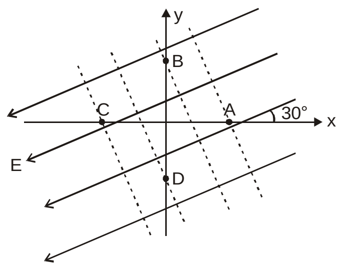
8. The rate of energy conversion from electrical form to chemical form is :
(A) 100 W (B) 500 W (C) 600 W (D) 700 W

Answers Key

1. (B) **2.** (C) **3.** (A) **4.** (B)
5. $t_1 > t_2$ **6.** (C) **7.** (A) **8.** (C)

Hints & Solutions

1. Four lines, perpendicular to lines of electric field and passing through A, B, C and D are drawn. These are equipotential lines. As potential decreases in the direction of electric field, therefore
$V_A > V_B > V_D > V_C$

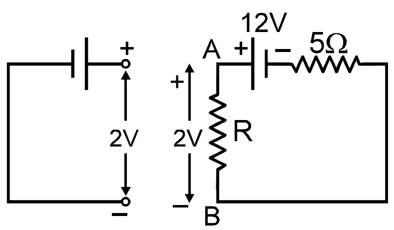


2. For A, $\frac{ds}{dt} = V_A = \frac{1}{\sqrt{3}}$

For B, $\frac{ds}{dt} = V_B = \sqrt{3}$

$\frac{V_A}{V_B} = \frac{1}{3}$.

3.



If pot. drop between A and B is also 2V, then no currrent will pass through the gelvanomter.

Pot. drop across R = $\left(\frac{12}{R+5}\right)R = 2$

12 R = 2R + 10
R = 1 Ω

4. Let the angular speed of disc when the balls reach the end be ω.

From conservation of angular momentum

$$\frac{1}{2} mR^2 \omega_0 = \frac{1}{2} mR^2 \omega + \frac{m}{2} R^2 \omega + \frac{m}{2} R^2 \omega$$

or $\omega = \frac{\omega_0}{3}$

5. In second case due to psuedo force acting on the block its acceleration will be more as compared to the first case.

Hence $t_1 > t_2$

Ans. $t_1 > t_2$

6. V = E + ir (during charging)

= 14 V.

7. $P = I^2 r$ (Due to internal resistance)

$= 50^2 \times 4 \times 10^{-2} = 100$ W

8. Rate of charging = E.I.

= 12 V. 50 A = 600 W