PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 50

Total Marks : 26

Max. Time : 28 min.

Topics : Current Electricity, Capacitance, Sound Wave, Kinematics

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]

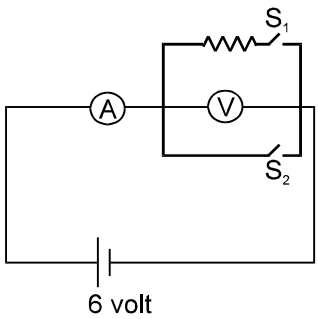
1. An ammeter and a voltmeter are initially connected in series to a battery of zero internal resistance. When switch S_1 is closed the reading of the voltmeter becomes half of the initial, whereas the reading of the ammeter becomes double. If now switch S_2 is also closed, then reading of ammeter becomes:

(A) 3/2 times the initial value

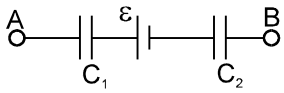
(B) 3/2 times the value after closing S_1

(C) 3/4 times the value after closing S_1

(D) 3/4 times the initial value



2. A circuit has a section AB shown in the figure. The emf of the source equals $\varepsilon = 10V$, the capacitance as of the capacitors are equal to $C_1 = 1.0\ \mu F$ and $C_2 = 2.0\ \mu F$, the potential difference $\phi_A - \phi_B = 5.0V$. The voltage across capacitor C_1 & C_2 is respectively :

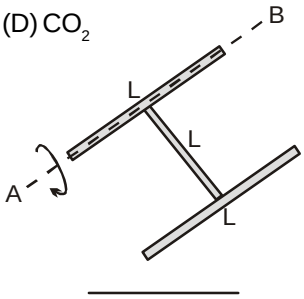


(A) 10/3 V, 5/3 V (B) 10/3 V, 10/3 V (C) 5/3 V, 5/3 V (D) 0 V,0 V

3. Under similar conditions of temperature and pressure, In which of the following gases the velocity of sound will be largest.

(A) H_2 (B) N_2 (C) He (D) CO_2

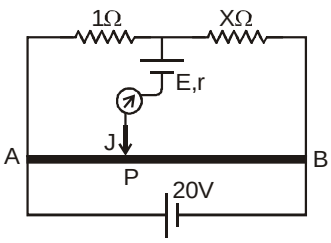
4. A rigid body is made of three identical thin rods fastened together in the form of letter H. The body is free to rotate about a fixed horizontal axis AB that passes through one of the legs of the H. The body is allowed to fall from rest from a position in which the plane of H is horizontal. What is the angular speed of the body when the plane of H is vertical. Top View of the figure in the initial position.



5. A man holding a flag is running in North-East direction with speed 10 m/s. Wind is blowing in east direction with speed $5\sqrt{2}$ m/s. Find the direction in which flag will flutter.

COMPREHENSION

AB is a uniform wire of meter bridge, across which an ideal 20 volt cell is connected as shown. Two resistor of $1\,\Omega$ and $X\,\Omega$ are inserted in slots of metre bridge. A cell of emf E volts and internal resistance r Ω and a galvanometer is connected to jockey J as shown.



6. If E = 16 volts, r = $4\,\Omega$ and distance of balance point P from end A is 90 cm, then the value of X is :

(A) $3\,\Omega$ (B) $6\,\Omega$ (C) $9\,\Omega$ (D) $12\,\Omega$

7. If E = 16 volts, r = $8\,\Omega$ and X = $9\,\Omega$, then the distance of balance point P from end A is :

(A) 10 cm (B) 30 cm (C) 60 cm (D) 90 cm

8. If E = 12 volts, X = $9\,\Omega$, then distance of balance point P from end A is

(A) 20 cm (B) 50 cm (C) 70 cm (D) Data insufficient

Answers Key

1. (B) **2.** (A) **3.** (A) **4.** $\omega = \sqrt{\frac{9g}{4\ell}}$

5. Flag will flutter in south direction. **6.** (C)

7. (D) **8.** (C)

Hints & Solutions

1. Initially :–

$V_v + V_A = 6$ ..(1)

; V_V & V_A being the potential across voltmeter & ammeter respectively

after closing S_1.

$\frac{V_v}{2} + 2V_A = 6$ ...(2)

Solving (1) & (2)

$V_v = 4$, $V_A = 2$.

after closing S_2 : –

$V_v = 0$

$V_A = 6$

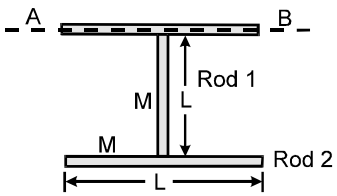
So that value after closing S_2 is 3/2 times the value after closing S_1.

2. **[Ans: $V_1 = \frac{10V}{3}$, $V_2 = \frac{5V}{3}$,]**

3. The speed of sound in air is $v = \sqrt{\frac{\gamma RT}{M}}$

$\frac{\gamma}{M}$ of H_2 is least, hence speed of sound in H_2 shall be maximum.

4.



Decrease in PE = Gain in rotational K.E.

$Mg\frac{L}{2} + MgL = I_{R_3} = I_{R_1} + I_{R_2}$

$\frac{1}{2}.\frac{4}{3}ML^2.\omega^2 = \frac{ML^2}{3}ML^2$

$\Rightarrow \frac{3}{2}MgL = \frac{2}{3}.ML^2.\omega^2 = \frac{4ML^2}{3}$

$\Rightarrow \frac{9g}{4L} = \omega^2 \quad \Rightarrow \omega = \sqrt{\frac{9g}{4L}}$

[Ans : $\omega = \sqrt{\frac{9g}{4L}}$]

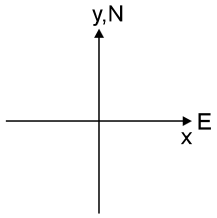
5. From given data

$\vec{V}_M = 5\sqrt{2}\,\hat{i} + 5\sqrt{2}\,\hat{j}$

velocity of man

Velocity of wind

$\vec{V}_W = 5\sqrt{2}\,\hat{i}$



The flag will flutter in the direction in which wind is blowing with respect to the man holding the flag.

$\Rightarrow \quad \vec{V}_{WM} = \vec{V}_W - \vec{V}_M$

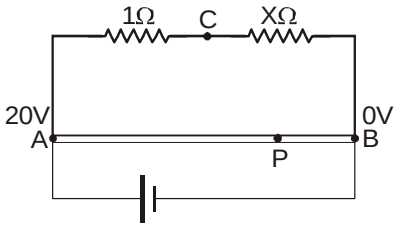
$\vec{V}_{WM} = (5\sqrt{2}\,\hat{i}) - (5\sqrt{2}\,\hat{i} + 5\sqrt{2}\,\hat{j})$

$\vec{V}_{WM} = -5\sqrt{2}\,\hat{j} = 5\sqrt{2}\,(-\hat{j})$

This implies direction of wind with respect to man in south.

Flag will flutter in south direction. Ans.

6.



Let reference potential of B be zero. No current shall flow through galvanometer.

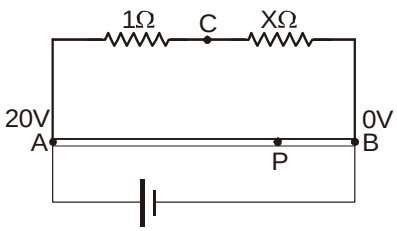
If $V_C - V_p = 16$ volts.

Now $V_p = 2$ volts.

$\therefore \quad V_c$ should be 18 volts.

Now $\dfrac{V_A - V_C}{1} = \dfrac{V_C - V_B}{X}$

Solving $X = 9\,\Omega$.



7. Balance point is independent of r. It can be seen for balance point at P, $V_C - V_P = E$ in absence of cell, jockey and galvanometer.

8. For balance point at P.

$V_C - V_P = E = 12$

$\because$ $V_C = 18$, V_P should be 6 volts.

Therefore

$$\frac{V_A - V_P}{\ell} = \frac{V_P - 0}{100 - \ell} \quad \text{or } \ell = 70 \text{ cm.}$$