PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 43

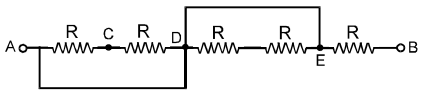
Total Marks : 23

Max. Time : 24 min.

Topics : Current Electricity, Elasticity & Viscosity, Geometrical Optics, Gravitation, Sound Wave, Rigid Body Dynamics

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.3	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.4 to Q.5	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. In the given circuit all resistors are of R ohm each. If a wire is connected between C and B, then the ratio of equivalent resistance between AB of original circuit to new circuit formed is:

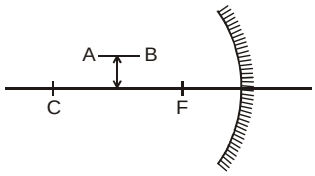


(A) 1 (B) 3 (C) 1/3 (D) 1/2

2. A sphere of mass m and radius r is projected in a gravity free space with speed v. If coefficient of viscosity is $\frac{1}{6\pi}$, the distance travelled by the body before it stops is :

(A) $\frac{mv}{2r}$ (B) $\frac{2mv}{r}$ (C) $\frac{mv}{r}$ (D) none of these

3. An object AB is placed parallel and close to the optical axis between focus F and centre of curvature C of a converging mirror of focal length f as shown in figure.



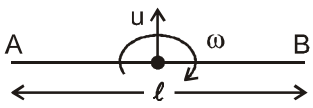
(A) Image of A will be closer than that of B from the mirror.
(B) Image of AB will be parallel to the optical axis.
(C) Image of AB will be straight line inclined to the optical axis.
(D) Image of AB will not be straight line.

4. A satellite is moving around the earth in a circular orbit and in this orbit magnitude of its acceleration is 'a_1'. Now a rocket is fired in the direction of motion of satellite from the satellite due to which its speed instantaneously becomes half of initial, just after the rocket is fired acceleration of satellite have magnitude 'a_2' . Then fill the ratio $\frac{a_1}{a_2}$ in answer sheet (Assume there is no external force other then the gravitational force of earth before and after the firing of rocket from the satellite)

5. A bird is singing on a tree and a man is hearing at a distance 'r' from the bird. Calculate the displacement of the man towards the bird so that the loudness heard by man increases by 20 dB. [Assume that the motion of man is along the line joining the bird and the man]

COMPREHENSION

A uniform rod AB of length 'ℓ' is thrown upwards such that initially AB is horizontal, velocity of centre is 'u' upwards and angular velocity 'ω' is such that velocity of 'B' at this moment is zero. The values of 'ω' and 'u' are also such that the rod becomes vertical first time at the moment when the centre of rod reaches the highest point of its motion.



6. The value of 'ω' in terms of 'u' and 'ℓ' is equal to

(A) $\frac{u}{\ell}$ (B) $\frac{2u}{\ell}$ (C) $\frac{u}{2\ell}$ (D) $\frac{u}{4\ell}$

7. The value of 'u' is equal to

(A) $\sqrt{\frac{\pi\ell g}{4}}$ (B) $\sqrt{g\ell}$ (C) $\sqrt{\frac{\pi\ell g}{2}}$ (D) $\sqrt{\frac{g\ell}{2}}$

8. The angular acceleration of the rod during the motion is

(A) $\frac{g}{\ell}$ (B) $\frac{2g}{\ell}$ (C) 0 (D) $\frac{u^2}{\ell}$

Answers Key

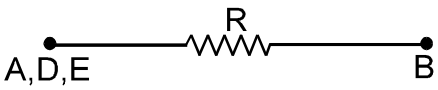
1. (B) **2.** (C) **3.** (A) (C) **4.** 1

5. $\frac{9r}{10}$ **6.** (B) **7.** (A) **8.** (C)

Hints & Solutions

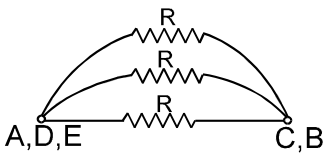
1. Originally

$V_A = V_D = V_E$

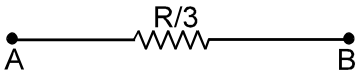


After connecting C & B. The equivalent circuit will be

[Now $V_A = V_D = V_E$ and $V_C = V_B$]



$\equiv$



$\therefore$ Ratio = 3.

2. The only force acting on the body is the viscous force

Here, $m\frac{vdv}{dx} = -6\pi\eta rv$

$= -rv$

$\Rightarrow \int_{v}^{0} mdv = \int_{0}^{x} -rdx \qquad \Rightarrow x = \frac{mv}{r}.$

3. The image of a point closer to the focus will be farther. As the transverse magnification of B will be more than A, the image of AB will be inclined to the optical axis.

4. $a_1 = \frac{F}{m} = \frac{GM}{r^2}$

It is same in both cases

$\therefore \quad \frac{a_1}{a_2} = 1$

5. Loudness $\beta = 10 \log_{10} \frac{I}{I_0}$

$\therefore \quad \beta_2 - \beta_1 = 10\log_{10} \frac{I_2}{I_1}$ &

$\because \quad I = \frac{P}{4\pi r^2}$

$\therefore \quad \frac{I_2}{I_1} = \frac{r_1^2}{r_2^2}$

$\therefore \quad (\beta + 20) - \beta = 10 \log_{10} \frac{r^2}{r_2^2}$

$= 20 \log_{10} \frac{r}{r_2}$

$\Rightarrow \quad \frac{r}{r_2} = 10 \qquad \Rightarrow \quad r_2 = 0.1r$

$\therefore \quad$ shift $= r - 0.1\ r = 0.9\ r.$

Ans. $\frac{9r}{10}$

Sol. 6 to 8

The angular speed of rod $= \omega = \frac{u - v_B}{\ell/2}$

As given $v_B = 0 \qquad \therefore \ \omega = \frac{2u}{\ell}$ **Ans.**

The time after which centre of rod reaches the highest point is $t_0 = \frac{u}{g}$

The angular acceleration of rod is zero and in the given time to the rod undergoes angular displacement $\frac{\pi}{2}$.

$\therefore$ from $\theta = \omega t$

$\Rightarrow \frac{\pi}{2} = \frac{2u}{\ell} \times \frac{u}{g}$ or $u = \sqrt{\frac{\pi g L}{4}}$