**PHYSICS**

**DPP**

DAILY PRACTICE PROBLEMS

# DPP No. 70

**Total Marks : 36**

**Max. Time : 42 min.**

**Topics : Heat, Magnetic Effect of Current and Magnetic Force on Charge/current, Rotation, Center of Mass, Geometrical Optics, 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]** |
| **Subjective Questions ('–1' negative marking) Q.4 to Q.7** | **(4 marks, 5 min.)** | **[16, 20]** |
| **Match the Following (no negative marking) (2 × 4) Q.8** | **(8 marks, 10 min.)** | **[8, 10]** |
| **Assertion and Reason (no negative marking) Q. 9** | **(3 marks, 3 min.)** | **[3 , 3]** |

**1.** A Galileo telescope has an objective of focal length 100 cm & magnifying power 50. The distance between the two lenses in normal adjustment will be

(A) 150 cm (B) 100 cm (C) 98 cm (D) 200 cm

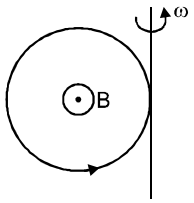
**2.** Let the wavelength at which the the spectral emissive power of a black body (at a temperature T ) is maximum, be denoted by $\lambda_{max}$ .As the temperature of the body is increased by 1 K , $\lambda_{max}$ decreases by 1 percent .The temperature T of the black body is

(A) 100K (B) 200K (C) 400K (D) 288K

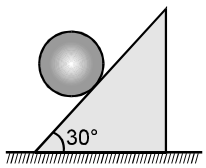
**3.** In the above question, the emissive power of the black body at temperature T is :

(A) 17 Watt/$m^2$ (B) 12 Watt/$m^2$ (C) 6 Watt/$m^2$ (D) 24 Watt/$m^2$

**4.** A current carrying ring, carrying current $\frac{2}{\pi}$ Amp., radius 1m, mass $\frac{2}{3}$ kg and having 10 windings is free to rotate about its tangential vertical axis. A uniform magnetic field of 1 tesla is applied perpendicular to its plane. How much minimum angular velocity (in rad/sec.) should be given to the ring in the direction shown, so that it can rotate 270º in that direction. Write your answer in nearest single digit in rad/sec.

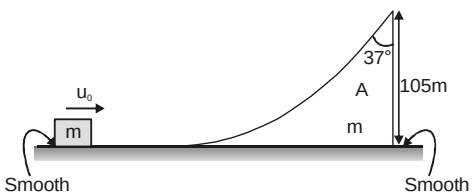



**5.** A uniform disc of mass 2 kg and radius 50 mm rolls from rest on a fixed rough incline. If the length of incline is 1 m the time taken by the disc to arrive at bottom equals _____.




**6.** Horizontal and vertical components of earth's magnetic field at a place are 0.22 tesla and 0.38 tesla respectively. Find the resultant intensity of earth's magnetic field.

**7** A special wedge of mass m is kept on a smooth horizontal surface as shown in figure. Another smooth block of mass m is projected towards the wedge with a horizontal velocity $u_0$ which then climbs up the wedge and leaves the wedge at the top most point. After this when block of mass m falls on horizontal surface distance between block and wedge is 'x'. If the maximum height attained by the mass m from ground is 125m then find x.

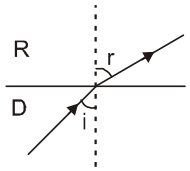


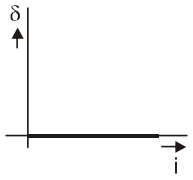
**8.** **Match the Column :**

For light passing from different surfaces shown, graph between deviation ($\delta$) versus angle of incidence (i) is drawn. Choose appropriate graph.

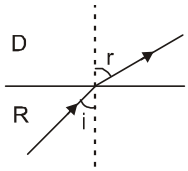
**Column–I** **Column–II**

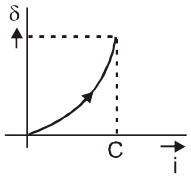
(A) Light goes from denser to rarear medium through plane surface (p)



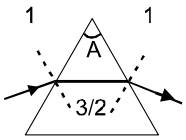



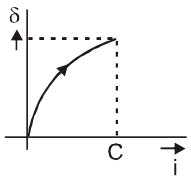

(B) Light goes from rarear to denser medium through plane surface (q)



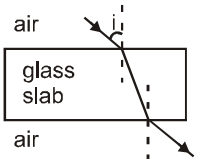



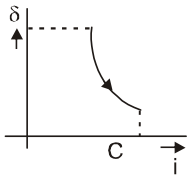

(C) Light goes through prism placed in air (r)




(D) Light pass through slab placed in air (s)




**9.** **Statement–1:** If potential difference between two points is non zero in an electric circuit, electric current between those two points may be zero.

**Statement–2:** Current always flows from high potential to low potential

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

# Answers Key

**1.** (C) **2.** (A) **3.** (C) **4.** 9

**5.** $t = \sqrt{\frac{6}{g}}$ sec. **6.** 0.44 T **7.** 105 m

**8.** (A) – (q) ; (B) – (r) ; (C) – (s) ; (D) – (p)

**9.** (C)

# Hints & Solutions

**1.** In normal adjustment

$$m = \frac{f_0}{f_e}$$

$$\text{so} \quad 50 = \frac{100}{f_e}$$

$$\Rightarrow \quad f_e = 2 \text{ cm}$$

($\because$ eyepiece is concave lens)
and $L = f_0 - f_e = 100 - 2 = 98$ cm

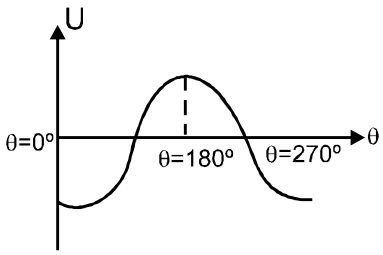
**2.** $\lambda_m T = \text{const.}$
$\ell n\, \lambda_m + \ell n T = C$

$$\frac{d\lambda_m}{\lambda_m} + \frac{dT}{T} = 0 \qquad \therefore \quad \frac{d\lambda_m}{\lambda_m} = -\frac{dT}{T}$$

Now $\frac{d\lambda_m}{\lambda_m} = -1\ \% = -\frac{1}{100}$ (–ve sign indicates decrease)
$dT = 1$ (given)
$\therefore$ T = 100 K.

**3.** Emissive power $= \sigma T^4$
$= 6 \times 10^{-8} \times 100^4$ W/m$^2$

**4.**




to reach $\theta = 270°$, it has to cross the potential energy barrier at $\theta = 180°$ and to cross $\theta = 180°$ angular velocity at $\theta = 180°$ should be $0^+$

$$k_i + U_i = k_f + U_y$$

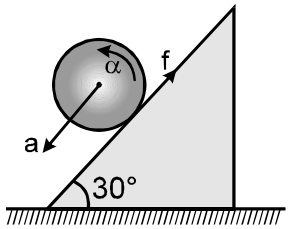
$$\frac{1}{2}\left(\frac{3}{2}MR^2\right)\omega^2 + (-Mi\ AB\ \cos 0°) = 0 + (-NiAB \cos 180°)$$

$$\omega = \sqrt{80} \approx 9 \text{ rad/sec.}$$

**5.** Equation for linear motion

$mg\sin\theta - f = ma$

for rotary motion




$f.R = I.\frac{a}{R} \Rightarrow f = \frac{I}{R^2}.$

$a \quad mg\sin\theta = ma + \frac{MR^2}{2.R^2}.a = \frac{3}{2}ma$

$a = \frac{2g\sin\theta}{3} = \frac{g}{3}$

using $S = ut + \frac{1}{2}at^2$ for linear motion.

$1 = 0 + \frac{1}{2}.\frac{g}{3}.t^2$

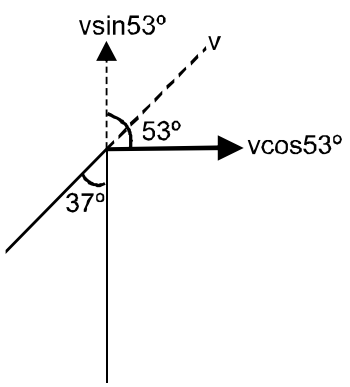
$t = \sqrt{\frac{6}{g}}$ sec. **Ans.**

**6.** Here $B_H = 0.22$ T ; $B_V = 0.38$ T

Now $B = \sqrt{B_H^{\,2} + B_V^{\,2}}$

$= \sqrt{(0.22)^2 + (0.38)^2} = \sqrt{0.1928}$ = **0.44 T**

**7.** w.r.t. the wedge



As maximum height = 125 m

$\Rightarrow$ block want by a height 20m over the wedge

$\Rightarrow$ $(v \sin 53^\circ)^2 = 2.g.20$

$$v^2 \frac{16}{25} = 400$$

$v^2 = 25 \times 25$

$v = 25$ m/sec.

$\Rightarrow$ block left the wedge with a relative velocity 25 m/sec.

Now, time of flight = 2 + 5 = 7 sec.

horizontal range w.r.t. wedge

$= v_x \times T$

$= 25 \cos 53 \times 7$

$= 105$ m.

**8.** For slab no deviation so $\delta = 0$ for any i

for slab for light from D to R

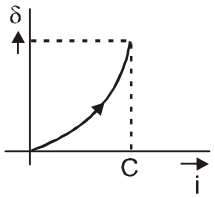
$\delta = r - i$ ....(i)

$n_d \sin i = n_r \sin r$

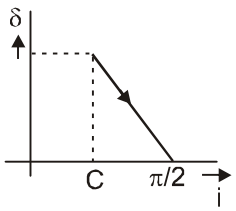
$$\Rightarrow r = \sin^{-1}\left[\frac{n_d}{n_r}\sin i\right]$$

$$\delta = \sin^{-1}\left[\frac{n_d}{n_r}\sin i\right] - i$$

it is non-linear function and graph is




After i > C T.I.R. will occur and graph is straight line for D to R



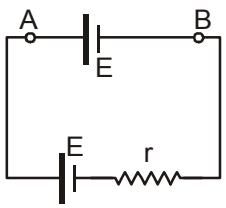

Similarly for light going from R to D

$$\delta = i - \sin^{-1}\left[\frac{n_r}{n_d}\sin i\right]$$

and for prism graph is drawn from

$i = i_{min}$ to $i = e$ that is graph(s)

**9.** Statement-2 is wrong as in this case




A is at high potential and B is at low potential and there is no current from A to B. It also justifies Statement-1.