

# Mastering Physics With Physics Guruji

## DPP - Daily Practice Problems

### Chapter-wise Sheets

Date :  Start Time :  End Time :

# PHYSICS

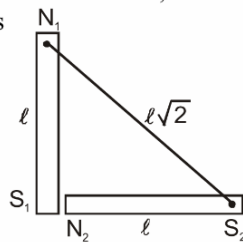
## CP19

SYLLABUS : Magnetism and Matter

Max. Marks : 120    Marking Scheme : (+4) for correct & (-1) for incorrect answer    Time : 60 min.

**INSTRUCTIONS** : This Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

- Two identical magnetic dipoles of magnetic moments  $1.0 \text{ A}\cdot\text{m}^2$  each, placed at a separation of 2 m with their axis perpendicular to each other. The resultant magnetic field at point midway between the dipole is
  - $5 \times 10^{-7} \text{ T}$
  - $\sqrt{5} \times 10^{-7} \text{ T}$
  - $10^{-7} \text{ T}$
  - $2 \times 10^{-7} \text{ T}$
- Two identical thin bar magnets each of length  $\ell$  and pole strength  $m$  are placed at right angles to each other, with north pole of one touching south pole of the other, then the magnetic moment of the system is
  - $1 m\ell$
  - $2 m\ell$
  - $\sqrt{2} m\ell$
  - $m\ell/2$
- Relative permittivity and permeability of a material  $\epsilon_r$  and  $\mu_r$ , respectively. Which of the following values of these quantities are allowed for a diamagnetic material?
  - $\epsilon_r = 0.5, \mu_r = 1.5$
  - $\epsilon_r = 1.5, \mu_r = 0.5$
  - $\epsilon_r = 0.5, \mu_r = 0.5$
  - $\epsilon_r = 1.5, \mu_r = 1.5$
- If the period of oscillation of freely suspended bar magnet in earth's horizontal field  $H$  is 4 sec. When another magnet is brought near it, the period of oscillation is reduced to 2s. The magnetic field of second bar magnet is
  - $4H$
  - $3H$
  - $2H$
  - $\sqrt{3}H$



RESPONSE GRID

1. (a)(b)(c)(d)    2. (a)(b)(c)(d)    3. (a)(b)(c)(d)    4. (a)(b)(c)(d)

Space for Rough Work

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5. A coil in the shape of an equilateral triangle of side  $l$  is suspended between the pole pieces of a permanent magnet such that  $\vec{B}$  is in the plane of the coil. If due to a current  $i$  in the triangle a torque  $\tau$  acts on it, the side  $l$  of the triangle is
  - (a)  $\frac{2}{\sqrt{3}} \left( \frac{\tau}{B.i} \right)^{\frac{1}{2}}$
  - (b)  $2 \left( \frac{\tau}{\sqrt{3}B.i} \right)^{\frac{1}{2}}$
  - (c)  $\frac{2}{\sqrt{3}} \left( \frac{\tau}{B.i} \right)$
  - (d)  $\frac{1}{\sqrt{3}} \frac{\tau}{B.i}$
6. A compass needle whose magnetic moment is  $60 \text{ Am}^2$ , is directed towards geographical north at any place experiencing moment of force of  $1.2 \times 10^{-3} \text{ Nm}$ . At that place the horizontal component of earth field is  $40 \text{ micro W/m}^2$ . What is the value of dip angle at that place?
  - (a)  $30^\circ$
  - (b)  $60^\circ$
  - (c)  $45^\circ$
  - (d)  $15^\circ$
7. The materials suitable for making electromagnets should have
  - (a) high retentivity and low coercivity
  - (b) low retentivity and low coercivity
  - (c) high retentivity and high coercivity
  - (d) low retentivity and high coercivity
8. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is  $2\text{ s}$ . The magnet is cut along its length into three equal parts and these parts are then placed on each other with their like poles together. The time period of this combination will be
  - (a)  $2\sqrt{3} \text{ s}$
  - (b)  $\frac{2}{3} \text{ s}$
  - (c)  $2 \text{ s}$
  - (d)  $\frac{2}{\sqrt{3}} \text{ s}$
9. A magnetic dipole is under the influence of two magnetic fields. The angle between the field directions is  $60^\circ$  and one of the fields has a magnitude of  $1.2 \times 10^{-2} \text{ T}$ . If the dipole comes to stable equilibrium at an angle of  $15^\circ$  with this field, what is the magnitude of other field?
  - (a)  $4.4 \times 10^{-3} \text{ tesla}$
  - (b)  $5.2 \times 10^{-3} \text{ tesla}$
  - (c)  $3.4 \times 10^{-3} \text{ tesla}$
  - (d)  $7.8 \times 10^{-3} \text{ tesla}$
10. A bar magnet  $8 \text{ cms}$  long is placed in the magnetic meridian with the N-pole pointing towards geographical north. Two neutral points separated by a distance of  $6 \text{ cms}$  are obtained on the equatorial axis of the magnet. If horizontal component of earth's field  $= 3.2 \times 10^{-5} \text{ T}$ , then pole strength of magnet is
  - (a)  $5 \text{ ab-amp} \times \text{cm}$
  - (b)  $10 \text{ ab-amp} \times \text{cm}$
  - (c)  $2.5 \text{ ab-amp} \times \text{cm}$
  - (d)  $20 \text{ ab-amp} \times \text{cm}$
11. If the susceptibility of dia, para and ferro magnetic materials are  $\chi_d, \chi_p, \chi_f$  respectively, then
  - (a)  $\chi_d < \chi_p < \chi_f$
  - (b)  $\chi_d < \chi_f < \chi_p$
  - (c)  $\chi_f < \chi_d < \chi_p$
  - (d)  $\chi_f < \chi_p < \chi_d$
12. The figure shows the various positions (labelled by subscripts) of small magnetised needles P and Q. The arrows show the direction of their magnetic moment. Which configuration corresponds to the lowest potential energy among all the configurations shown?
 
  - (a)  $PQ_3$
  - (b)  $PQ_4$
  - (c)  $PQ_5$
  - (d)  $PQ_6$
13. A magnetic needle is kept in a non-uniform magnetic field. It experiences
  - (a) neither a force nor a torque
  - (b) a torque but not a force
  - (c) a force but not a torque
  - (d) a force and a torque
14. The angle of dip at a place is  $37^\circ$  and the vertical component of the earth's magnetic field is  $6 \times 10^{-5} \text{ T}$ . The earth's magnetic field at this place is ( $\tan 37^\circ = 3/4$ )
  - (a)  $7 \times 10^{-5} \text{ T}$
  - (b)  $6 \times 10^{-5} \text{ T}$
  - (c)  $5 \times 10^{-5} \text{ T}$
  - (d)  $10^{-4} \text{ T}$

**RESPONSE  
GRID**

- |                  |                  |                  |                  |                  |
|------------------|------------------|------------------|------------------|------------------|
| 5. (a)(b)(c)(d)  | 6. (a)(b)(c)(d)  | 7. (a)(b)(c)(d)  | 8. (a)(b)(c)(d)  | 9. (a)(b)(c)(d)  |
| 10. (a)(b)(c)(d) | 11. (a)(b)(c)(d) | 12. (a)(b)(c)(d) | 13. (a)(b)(c)(d) | 14. (a)(b)(c)(d) |

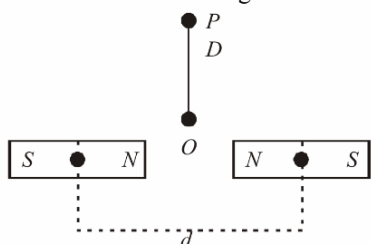
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15. Needles  $N_1$ ,  $N_2$  and  $N_3$  are made of a ferromagnetic, a paramagnetic and a diamagnetic substance respectively. A magnet when brought close to them will
- attract  $N_1$  and  $N_2$  strongly but repel  $N_3$
  - attract  $N_1$  strongly,  $N_2$  weakly and repel  $N_3$  weakly
  - attract  $N_1$  strongly, but repel  $N_2$  and  $N_3$  weakly
  - attract all three of them
16. A vibration magnetometer consists of two identical bar magnets placed one over the other such that they are perpendicular and bisect each other. The time period of oscillation in a horizontal magnetic field is  $2^{5/4}$  seconds. One of the magnets is removed and if the other magnet oscillates in the same field, then the time period in seconds is
- $2^{1/4}$
  - $2^{1/2}$
  - 2
  - $2^{3/4}$
17. Two identical bar magnets are fixed with their centres at a distance  $d$  apart. A stationary charge  $Q$  is placed at  $P$  in between the gap of the two magnets at a distance  $D$  from the centre  $O$  as shown in the Figure



The force on the charge  $Q$  is

- directed perpendicular to the plane of paper
  - zero
  - directed along  $OP$
  - directed along  $PO$
18. The magnetic field of earth at the equator is approximately  $4 \times 10^{-5}$  T. The radius of earth is  $6.4 \times 10^6$  m. Then the dipole moment of the earth will be nearly of the order of:
- $10^{23}$  A m<sup>2</sup>
  - $10^{20}$  A m<sup>2</sup>
  - $10^{16}$  A m<sup>2</sup>
  - $10^{10}$  A m<sup>2</sup>
19. Which of the following is not correct about relative magnetic permeability ( $\mu_r$ )?
- It is a dimensionless pure ratio.

- For vacuum medium its value is one.
  - For ferromagnetic materials  $\mu_r \gg 1$
  - For paramagnetic materials  $\mu_r < 1$ .
20. A bar magnet of moment of inertia  $9 \times 10^{-5}$  kg m<sup>2</sup> placed in a vibration magnetometer and oscillating in a uniform magnetic field  $16\pi^2 \times 10^{-5}$  T makes 20 oscillations in 15 s. The magnetic moment of the bar magnet is
- 3 Am<sup>2</sup>
  - 2 Am<sup>2</sup>
  - 5 Am<sup>2</sup>
  - 4 Am<sup>2</sup>
21. Two short bar magnets P and Q are arranged such that their centres are on the X-axis and are separated by a large distance. The magnetic axes of P and Q are along X and Y axes respectively. At a point R, midway between their centres, if B is the magnitude of induction due to Q, the magnitude of total induction at R due to the both magnets is
- 3B
  - $\sqrt{5}B$
  - $\frac{\sqrt{5}}{2}B$
  - B
22. A dip circle is so set that its needle moves freely in the magnetic meridian. In this position, the angle of dip is  $40^\circ$ . Now the dip circle is rotated so that the plane in which the needle moves makes an angle of  $30^\circ$  with the magnetic meridian. In this position, the needle will dip by an angle
- $40^\circ$
  - $30^\circ$
  - more than  $40^\circ$
  - less than  $40^\circ$
23. A watch glass containing some powdered substance is placed between the pole pieces of a magnet. Deep concavity is observed at the centre. The substance in the watch glass is
- iron
  - chromium
  - carbon
  - wood
24. Imagine rolling a sheet of paper into a cylinder and placing a bar magnet near its end as shown in figure. What can you say about the sign of  $\vec{B} \cdot d\vec{A}$  for every area  $d\vec{A}$  on the surface?
- 
- Positive
  - Negative
  - No sign
  - Can be positive or negative

**RESPONSE  
GRID**

- |                  |                  |                  |                  |                  |
|------------------|------------------|------------------|------------------|------------------|
| 15. (a)(b)(c)(d) | 16. (a)(b)(c)(d) | 17. (a)(b)(c)(d) | 18. (a)(b)(c)(d) | 19. (a)(b)(c)(d) |
| 20. (a)(b)(c)(d) | 21. (a)(b)(c)(d) | 22. (a)(b)(c)(d) | 23. (a)(b)(c)(d) | 24. (a)(b)(c)(d) |

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25. A magnetic needle lying parallel to a magnetic field requires  $W$  units of work to turn it through  $60^\circ$ . The torque required to keep the needle in this position will be
- (a)  $2W$       (b)  $W$       (c)  $\frac{W}{\sqrt{2}}$       (d)  $\sqrt{3}W$
26. The earth's magnetic field lines resemble that of a dipole at the centre of the earth. If the magnetic moment of this dipole is close to  $8 \times 10^{22} \text{ Am}^2$ , the value of earth's magnetic field near the equator is close to (radius of the earth =  $6.4 \times 10^6 \text{ m}$ )
- (a) 0.6 Gauss      (b) 1.2 Gauss  
(c) 1.8 Gauss      (d) 0.32 Gauss
27. Two short bar magnets of length 1 cm each have magnetic moments  $1.20 \text{ Am}^2$  and  $1.00 \text{ Am}^2$  respectively. They are placed on a horizontal table parallel to each other with their N poles pointing towards the South. They have a common magnetic equator and are separated by a distance of 20.0 cm. The value of the resultant horizontal magnetic induction at the mid-point O of the line joining their centres is close to (Horizontal component of earth's magnetic induction is  $3.6 \times 10^{-5} \text{ Wb/m}^2$ )
- (a)  $3.6 \times 10^{-5} \text{ Wb/m}^2$       (b)  $2.56 \times 10^{-4} \text{ Wb/m}^2$   
(c)  $3.50 \times 10^{-4} \text{ Wb/m}^2$       (d)  $5.80 \times 10^{-4} \text{ Wb/m}^2$
28. The coercivity of a small magnet where the ferromagnet gets demagnetized is  $3 \times 10^3 \text{ Am}^{-1}$ . The current required to be passed in a solenoid of length 10 cm and number of turns 100, so that the magnet gets demagnetized when inside the solenoid, is:
- (a) 30 mA      (b) 60 mA      (c) 3 A      (d) 6 A
29. A thin rectangular magnet suspended freely has a period of oscillation equal to  $T$ . Now it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is  $T'$ , the ratio  $\frac{T'}{T}$  is
- (a)  $\frac{1}{2\sqrt{2}}$       (b)  $\frac{1}{2}$       (c) 2      (d)  $\frac{1}{4}$
30. Which of the following statements is incorrect about hysteresis ?
- (a) This effect is common to all ferromagnetic substances  
(b) The hysteresis loop area is proportional to the thermal energy developed per unit volume of the material  
(c) The hysteresis loop area is independent of the thermal energy developed per unit volume of the material  
(d) The shape of the hysteresis loop is characteristic of the material

**RESPONSE  
GRID**

25. (a)(b)(c)(d)    26. (a)(b)(c)(d)    27. (a)(b)(c)(d)    28. (a)(b)(c)(d)    29. (a)(b)(c)(d)  
30. (a)(b)(c)(d)

## DAILY PRACTICE PROBLEM DPP CHAPTERWISE CP19 - PHYSICS

Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	45	Qualifying Score	60
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct $\times$ 4) – (Incorrect $\times$ 1)			

Space for Rough Work