# PHYSICS

**The following questions consists of two statements each, printed as Assertion and Reason. While answering these questions you are to choose any one of the following five responses.**

**(A) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.**

**(B) If both Assertion and Reason are true but Reason is not correct explanation of the Assertion.**

**(C) If Assertion is true but the Reason is false.**

**(D) Both Assertion and Reason are false.**

**(E) If Assertion is false but Reason is true.**

**Q.1** **Assertion** : Poles of a magnet can never be separated.
**Reason** : Since each atom of a magnetic material is a magnet in itself. **[A]**

**Q.2** **Assertion** : A tangent galvanometer is used for measuring current
**Reason** : As it is direct reading. **[C]**

**Q.3** **Assertion** : To protect any instrument from external magnetic field, it is put inside an iron box.
**Reason** : Iron is a magnetic substance. **[E]**

**Q.4** **Assertion** : Time period of vibration in sum position (in a vibration magnetometer) is larger than the period of vibration in difference position.
**Reason** : Since moment of inertia increases in sum position. **[D]**

**Q.5** **Assertion** : For making permanent magnets steel is preferred over soft iron.
**Reason** : As retentivity of steel is smaller. **[B]**

**Q.6** **Assertion :** A copper wire connected to a closed circuit is surrounded by a thick iron shell and introduced together with the shell into the space between the poles of an electromagnet iron shell acts as a magnetic screen for the wire and an emf will not induced in the wire.
**Reason :** Iron is a ferromagnetic material. **[D]**

**Q.7** **Assertion :** Basic difference between an electric line and magnetic line of force is that former does not form close loop and the later form continuous loop.
**Reason :** Electric field is conservative whereas magnetic field is non conservative. **[A]**

**Q.8** **Statement 1** – Earth's magnetic field changes both in magnitude and direction as time passes.
**Statement 2** – In the magnetic northern hemisphere , the vertical component of the earth's magnetic field points upward .
(A) statement 1 is correct and statement 2 is correct and statement 2 is a correct explanation of statement 1.
(B) statement 1 is correct and statement 2 is correct but statement 2 is not a correct explanation of statement 1.
(C) statement 1 is correct and statement 2 is false.
(D) statement 1 is false and statement 2 is correct. **[C]**

**Q.9** **Statement I :** A freely suspended magnet points along north-south direction.
**Statement II :** Since earth behaves as magnet. **[A]**

**Q.10** **Statement I :** Poles of a magnet can never be separated.
**Statement II :** Since each atom of a magnetic material is a magnet in itself. **[A]**

**Q.11** **Statement I :** To protect any instrument from external magnetic field , it put inside an iron box.
**Statement II :** Iron is magnetic substance. **[B]**

**Q.12** **Statement I :** Reduction factor (K) of a tangent galvanometer helps in reducing deflection of current.
**Statement II :** As reduction factor increases with increase of current. **[C]**

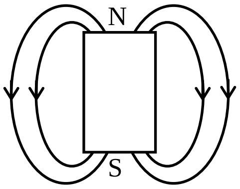
**Q.13** **Statement I :** The susceptibility of diamagnetic materials does not depend upon temperature.
**Statement II :** Every atom of a diamagnetic material is not a complete magnetic in itself. **[A]**

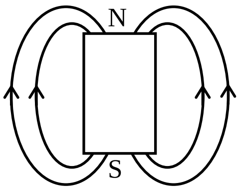
**Q.14** **Assertion :** Magnetic moment of an atom is due to both, the orbital motion and spin motion of every electron.

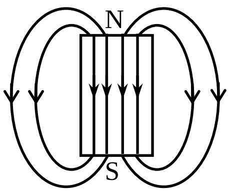
**Reason :** A charged particle produces a magnetic field.

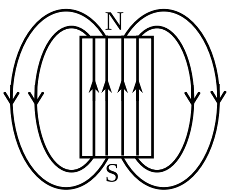
**Sol.** **[C]**

**Q.1** The magnetic field lines due to a bar magnet are correctly shown in - **[IIT-2002]**

(A)



(B)



(C)



(D)



**[D]**

**Q.2** Work done in turning a magnet of magnetic moment M by an angle of 90° from the magnetic meridian is n times the corresponding work done to turn through an angle of 60°, where n is -

(A) 1/2 (B) 2

(C) 1/4 (D) 1

**[B]**

**Q.3** The time period of oscillation of a magnet is 2 sec. When it is remagnetised so that its pole strength is 4 times, its period will be -

(A) 4 sec (B) 2 sec

(C) 1 sec (D) 8 sec

**[C]**

**Q.4** The magnetic suceptibility for diamagnetic materials is -

(A) small and negative (B) small and positive

(C) large and positive (D) large and negative

**[A]**

**Q.5** If a diamagnetic solution is poured into a U-tube and one arm of this U-tube is placed between the poles of a strong magnet, with the meniscus in line with the field, then the level of solution will -

(A) rise (B) fall

(C) oscillate slowly (D) remain as such

**[B]**

**Q.6** If a diamagnetic substance is brought near north or south pole of a bar magnet, it is -

(A) attracted by poles

(B) repelled by poles

(C) repelled by north pole and attracted by south pole

(D) attracted by north pole and repelled by south pole **[B]**

**Q.7** Of dia, para and ferromagnetism, the universal property of all substances is -

(A) diamagnetism (B) paramagnetism

(C) ferromagnetism (D) all of the above

**[A]**

**Q.8** A diamagnetic material in a magnetic field moves

(A) perpendicular to field

(B) from stronger to weaker parts of field

(C) from weaker to stronger parts of the field

(D) none of the above directions

**[B]**

**Q.9** Curie temperature is the temperature above which -

(A) a ferromagnetic material becomes paramagnetic

(B) a paramagnetic material becomes

diamagnetic

(C) a ferromagnetic material becomes diamagnetic

(D) a paramagnetic material becomes ferromagnetic

**[A]**

**Q.10** 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) $\frac{1}{4}$

**[B]**

**Q.11** Relative permittivity and permeability of a material $\varepsilon_r$ and $\mu_r$, respectively. Which of the following values of these quantities are allowed for a diamagnetic material ?

(A) $\varepsilon_r = 0.5$, $\mu_r = 1.5$ (B) $\varepsilon_r = 1.5$, $\mu_r = 0.5$

(C) $\varepsilon_r = 0.5$, $\mu_r = 0.5$ (D) $\varepsilon_r = 1.5$, $\mu_r = 1.5$

**[B]**

**Q.12** At a certain place, horizontal component is $\sqrt{3}$ times the vertical component. The angle of dip at this place is -

(A) 0 (B) $\pi/3$

(C) $\pi/6$ (D) none

**[C]**

**Q.13** A dip circle is so set that its needle moves freely in the magnetic meridian. In this position, the angle of dip is 40°. Now the dip circle is rotated so that the plane in which the needle moves makes an angle of 30° with the magnetic meridian. In this position, the needle will dip by an angle -

(A) 40° (B) 30°

(C) more than 40° (D) less than 40°

**[D]**

**Q.14** The material 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

**[B]**

**Q.15** Two magnets are held together in a vibration magnetometer and are allowed to oscillate in the earth's magnetic field with like poles together. 12 oscillations per minute are made but for unlike poles together only 4 oscillations per minute are executed. The ratio of their magnetic moments is -

(A) 3 : 1 (B) 1 : 3

(C) 3 : 5 (D) 5 : 4

**[D]**

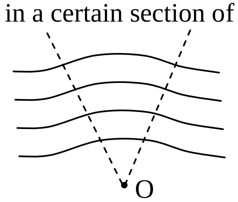
**Q.16** Two identical mangetic dipoles of magnetic moments 1.0 A-m$^2$ each, placed at a separation of 2m with their axes perpendicular to each other. The resultant magnetic field at a point midway between the dipole is -

(A) $5 \times 10^{-7}$ T (B) $\sqrt{5} \times 10^{-7}$ T

(C) $10^{-7}$ T (D) $2 \times 10^{-7}$ T

**[B]**

**Q.17** If the magnetic lines of force are shaped like arcs of concentric circles with their centre at point O in a certain section of a magnetic field:




(A) The intensity of the field in this section should at each point be inversely proportional to its distance from point O

(B) The intensity of the field in this section should at each point be inversely proportional to square of its distance from point O

(C) The intensity of the field in this section should at each point be inversely proportional to cube of its distance from point O

(D) Nothing can be said **[A]**

**Q.18** A magnet is suspended horizontally in the earth's magnetic field. When it is displaced and released, it oscillates in a horizontal plane with a period T. If a piece of wood of same M.I as the magnet is attached to the magnet is attached to the magnet, the new period of oscillation of the system would be -

(A) $\frac{T}{3}$ (B) $\frac{T}{2}$

(C) $\frac{T}{\sqrt{2}}$ (D) $\sqrt{2}T$ **[D]**

**Q.19** A short magnet produces a deflection of 30° when placed at certain distance in tanA position of magnetometer. If another short magnet of double the length and thrice the pole strength is placed at the same distance in tanB position of the magnetometer, the deflection produced will be -

(A) 60° (B) 30°

(C) 45° (D)None

**[A]**

**Q.20** The ratio of magnetic fields due to a smaller bar magnet in the end on position to broad side on position is-

(A) 1/4 (B) 1/2

(C) 1 (D) 2

**[D]**

**Q.21** Potential energy of a bar magnet of magnetic moment M placed in a magnetic field of induction B such that it makes an angle θ with the direction of B is -

(A) MB sin θ (B) – MB cos θ

(C) MB (1 – cos θ) (D) MB (1+ cosθ)

**[B]**

**Q.22** In the above question, torque acting on magnet is -

(A) MB sin θ (B) – MB cos θ

(C) MB cos θ (D) MB (1 – cos θ)

**[A]**

**Q.23** In Q.No. 3 position of stable equilibrium of magnet is given by θ equal to -

(A) 0º (B) 90º

(C) 45º (D) 180º

**[A]**

**Q.24** A current of 3 A is flowing in a plane circular coil of radius 4 cm and number of turns 20. The coil is placed in a uniform magnetic field of magnetic induction 0.5 T. Then the dipole moment of the coil is -

(A) 3000 $Am^2$ (B) 0.3 $Am^2$

(C) 300 A $m^2$ (D) 75 A $m^2$

**[B]**

**Q.25** A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon -

(A) area of loop (B) shape of loop

(C) value of current (D) magnetic field

**[B]**

**Q.26** The points A and B are situated perpendicular to the axis of 2 cm long bar magnet at large distances x and 3 x from the centre on opposite sides. The ratio of magnetic fields at A and B will be approximately equal to -

(A) 27 : 1 (B) 1 : 27

(C) 9 : 1 (D) 1 : 9

**[A]**

**Q.27** A compass needle is placed at the magnetic pole it -

(A) points N–S

(B) points E–W

(C) becomes vertical

(D) may staying any direction

**[D]**

**Q.28** A bar magnet is cut into two equal halved by a plane parallel to the magnetic axis. Of the following physical quantities the one which remains unchanged is -

(A) Pole strength

(B) Magnetic moment

(C) Intensity of magnetisation

(D) Moment of inertia

**[C]**

**Q.29** Two isolated point poles of strength 30 A-m and 60 A-m are placed at a distance of 0.3 m. The force of repulsion is -

(A) $2 \times 10^{-3}$ N (B) $2 \times 10^{-4}$ N

(C) $2 \times 10^{5}$ N (D) $2 \times 10^{-5}$ N

**[A]**

**Q.30** Magnetic lines of force are -
(A) continuous
(B) discontinuous
(C) sometimes continuous and sometimes discontinuous
(D) nothing can be said **[A]**

**Q.31** Units of pole strength of a magnet are -
(A) A $m^{-1}$ (B) A $m^2$
(C) A $m^{-2}$ (D) Am **[D]**

**Q.32** Magnetic monopoles cannot exist -
(A) true
(B) false
(C) may be true or false
(D) nothing can be said **[A]**

**Q.33** A tiny loop of current behaves as a magnetic dipole -
(A) true
(B) false
(C) may be true or false
(D) nothing can be said **[A]**

**Q.34** Magnetic field intensity due to a dipole varies as $d^n$, where n =
(A) 2 (B) –2
(C) 3 (D) – 3 **[D]**

**Q.35** A short bar magnet place with its axis at 30º, with a uniform external magnetic field of 0.25 T experiences a torque of 4.5 × $10^{-2}$ N-m Magnetic moment of the magnet is -
(A) 0.36 $JT^{-1}$ (B) 0.72 $JT^{-1}$
(C) 0.18 $JT^{-1}$ (D) zero **[A]**

**Q.36** A closely wound solenoid of 800 turns has area of cross section 2.5 $cm^2$. Magnetic moment associated with it, when it carries a current of 3 A is -
(A) 0.6 $JT^{-1}$ (B) 0.06 $JT^{-1}$
(C) 6 $JT^{-1}$ (D) None of these
**[A]**

**Q.37** The magnetic field strength at distance d due to an isolated pole of strength m ampere is-
(A) $\frac{\mu_0}{4\pi}\frac{m}{d}$ (B) $\frac{\mu_0}{4\pi}\frac{m}{d^3}$
(C) $\frac{\mu_0}{4\pi}\frac{m}{(d^2-t^2)}$ (D) $\frac{\mu_0}{4\pi}$ m/$d^2$
**[D]**

**Q.38** The magnetic field due to a magnetic dipole of magnetic moment M at a point on the axis of the dipole and at a distance d from it (in CGS Unit) is given by -
(A) $M/d^2$ (B) $2M/d^2$
(C) $2M/d^3$ (D) $2M/d^4$
**[C]**

**Q.39** The magnetic moment of a magnet is 0.1 amp × $m^2$ . It is suspended in a magnetic field of intensity 3 × $10^{-4}$ Weber/$m^2$. The couple acting upon it when deflected by 30º from the magnetic field is -
(A) 1 × $10^{-5}$ Nm (B) 1.5 × $10^{-5}$ Nm
(C) 2 × $10^{-5}$ Nm (D) 2.5 × $10^{-5}$ Nm
**[B]**

**Q.40** In the unmagnetized state, magnetic domains of a magnetic substance are oriented at -
(A) 60º (B) 90º
(C) Randomly (D) zero
**[C]**

**Q.41** The time period of a freely suspended magnet does not depend upon -
(A) length of magnet
(B) pole strength of magnet
(C) horizontal component of earth's field
(D) length of the suspension
**[D]**

**Q.42** The magnetic induction B and the force F on a pole m are related by -
(A) B = mF (B) $F = \frac{B}{m}$
(C) F = mB (D) None of these
**[C]**

**Q.43** Calculate force exerted on a point N pole of 3200 A-m placed 10 cm away from a point south pole of 10 A-m in air -

(A) 1 N (B) 0.32 N

(C) 2 N (D) 3 N

**[B]**

**Q.44** Force acting on a magnetic pole of $7.5\times10^{-2}$ A-m is 1.5 N. Magnetic field at the point is -

(A) 20 $Wb/m^2$ (B) 50 $Wb/m^2$

(C) 112.5 T (D) 2.0 T

**[A]**

**Q.45** Magnetic potential at a point distant d from a magnetic pole of strength m is -

(A) $\frac{\mu_0}{4\pi}\frac{m}{d}$ (B) $\frac{\mu_0}{4\pi}\frac{m}{d^2}$

(C) $\frac{\mu_0}{4\pi}\frac{2m}{d}$ (D) None of these

**[A]**

**Q.46** Force between two magnetic poles depends on -

(A) pole strength only

(B) distance only

(C) medium only

(D) All the three above **[D]**

**Q.47** A point at which two or more magnetic fields cancel each other is called -

(A) focal point (B) inversion point

(C) neutral point (D) none of these

**[C]**

**Q.48** The horizontal component of earth's magnetic field at any place is $0.36 \times 10^{-4}$ Weber/$m^2$. If the angle of dip at that place is 60º then the value of vertical component of earth's magnetic field will be (in Wb/$m^2$) -

(A) $0.12 \times 10^{-4}$ (B) $0.24 \times 10^{-4}$

(C) $0.40 \times 10^{-4}$ (D) $0.62 \times 10^{-4}$

**[D]**

**Q.49** The value of angle of dip at a place on earth is 45º. If the horizontal component of earth's magnetic field is 5 x $10^{-5}$ Tesla then the total magnetic of earth's magnetic field of earth will be -

(A) $5\sqrt{2} \times 10^{-5}$ Tesla

(B) $10\sqrt{2} \times 10^{-5}$ Tesla

(C) $15\sqrt{2} \times 10^{-5}$ Tesla

(D) zero **[A]**

**Q.50** At a certain place, horizontal component is $\sqrt{3}$ times the vertical component. The angle of dip of this place is -

(A) 0 (B) $\pi/3$

(C) $\pi/6$ (D) none of these

**[C]**