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JEE MAINS SAMPLE PAPER

PHYSICS

1. A metal rod moves at a constant velocity in a direction perpendicular to its length. A constant, uniform magnetic field exists in space in a direction perpendicular to the rod as well as its velocity. Select the correct statement from the following

(a) the entire rod is at the same electric potential

(b) there is an electric field in the rod

(c) the electric potential is highest at the centre for the rod and decreases towards at its ends

(d) the electric potential is lowest at the centre of the rod, and increases towards its ends.

2. A small circular loop of radius r is placed inside a circular loop of radius R (R >> r). The loops are coplanar and their centers coincide. The mutual inductance of the

system is proportional to

(a) r/R (b) r2/R

(c) r/R2 (d) r2/R2

3. The figure shows a part of a complete circuit. The potential difference VB – VA

when the current I is 5A and is decreasing at a rate of 103 As–1 is given by

(a) 5 V (b) 10 V

(c) 15 V (d) 20 V

4. A train travelling with the speed of 90 km/hr at the north pole has axle of length 1m.

If earth's magnetic field at the north pole has magnitude of 5 × 10–4 T. The induced

emf in the rod is

(a) 6.25 mV (b) 12.50 mV

(c) 25.50 mV (d) zero

5. A bar magnet is moved between two parallel circular loops A and B with a constant

velocity v as shown in figure. Then

(a) The current in each loop flows in the same direction

(b) The current in each loop flows in the opposite direction

(c) The loops will repel each other

(d) The loops will vibrate.

I

A B

1 □ 5 mH

15 V

A B

v

S N

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6. A time – varying magnetic field produces an induced electric field E, then which of

the following statement is wrong

(a) E is a non-conservative field

(b) The potential of E is not defined

(c) Field lines of E form closed loops

(d) The field E is electrostatic

7. The figure shows a straight wire lying in the plane of the paper and a uniform

magnetic field perpendicular to the plane of the paper. The ends C and D are slowly

turned to form a ring of radius R so that the entire magnetic field is confined in it.

The emf induced in the ring is given by

(a) (b)

(c) zero (d) none of these

8. A semicircle conducting ring of radius R is radius in the xy plane, as shown in the

figure. A uniform magnetic field is set up along the x-axis. No emf, will be induced in

the ring, if

(a) it moves along the x-axis

(b) it moves along the y-axis

(c) it moves along the z-axis

(d) all of these

9. There is increasing magnetic field through a conducting ring as shown in figure. The

direction of induced current as seen from above the plane of coil is

(a) clockwise

(b) anticlockwise

(c) no induced current

(d) first clockwise then anticlockwise

C D

× × ×

× × ×

× × × ×

C D

B

2 R B

2

2

R B

y

x

B

R

z

B

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10. The variation of induced emf (

) with time t in a coil if a short bar magnet is moved

along its axis with a constant velocity is best represented as

(a) (b)

(c) (d)

11. A coil having an inductance of H and a resistance of 300 ohm is connected to a

220 V, 200 Hz ac source. The phase angle between voltage and current is

(a) (b)

(c) (d)

12. In a series LCR circuit, voltage across inductor and capacitor is 500 V each. The

value of resistor is 40

. If the applied voltage is 200 V, then the value voltage

across the resistor is

(a) 1200 V (b) 200 V

(c) 800 V (d) 600 V

13. For the circuit shown in figure, the current through the inductor is 0.8 A, while the

current through the capacitor is 0.6 A. The current drawn from the ac source is

(a) 1.2 A (b) 1.0 A

(c) 0.6 A (d) 0.2 A

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t

t

t

t

t

1

1 3

tan

4

□□□□□□□

1 4

tan

3

□□□□□□□

1 4

tan

5

□□□□□□□

1 5

tan

4

□ □ □ □ □ □ □

V

A

C

□□□

L

500 V 500 V

200 V, 50 Hz

C

L

14. A parallel beam of light is incident on a converging lens parallel to its principal axis.

As one moves away from the lens on the other side on its principal axis, the

intensity of light

(a) remains constant

(b) continuously increases

(c) continuously decreases

(d) first increases and becomes maximum at the focus then decreases

15. An object is placed at a distance of 15 cm from a convex lens of focal length 10 cm.

On the other side of the lens, a convex mirror is placed at its focus such that the

image coincide with the object. The focal length of the convex mirror is

(a) 20 cm (b) 10 cm

(c) 15 cm (d) 30 cm

16. The size of the image of an object, which is at infinity, as formed by a convex lens

of focal length 30 cm is 2 cm. If a concave lens of focal length 20 cm is placed

between the convex lens and the iamge at a distance of 26 cm from the convex

lens, calculate the new size of the image

(a) 1.25 cm (b) 2.5 cm

(c) 1.05 cm (d) 2.0 cm

17. A ray of light is incident at the glass-water interface at an angle i, it emerges finally

parallel to the surface of water, then the value of

g would be

(a) (4/3) sin i (b) 1/sin i

(c) 4/3 (d) 1

18. When an object is at distances u1 and u2 from a convex lens, a real image and a

virtual image is formed respectively having same magnification. The focal length of

the lens is

(a) u1 – u2 (b)

(c) (d) u1 + u2

Air

Water

Glass

r

r

i

w=4/3

g

u u 1 2

2

u u 1 2

2

O

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19. An equilateral prism is silvered at one face and a monochromatic ray of light

incident on unsilvered face. If light ray retraces its path then angle of incidence is (

is the refractive index of prism)

(a) (b)

(c) (d)

20. Two identical p-njunctions may be connected in series with a battery in three ways

(figure). The potential difference across the two p-n junctions are equal in

(a) circuit 1 and circuit 2

(b) circuit 2 and circuit 3

(c) circuit 3 and circuit 1

(d) circuit 1 only

21. The figure shows the wave forms for two inputs A and B and that for the output Y of

a logic circuit. The logic circuit is

(A)

(B)

(Y)

(a) an AND gate (b) an OR gate

(c) a NAND gate (d) a NOT gate

22. Light from a hydrogen discharge tube is incident on the cathode of a photoelectric

cell. The work function of the cathode surface is 4.2 eV. In order to reduce the

photo current to zero, the voltage of anode relative to the cathode must be made

(a) – 4.2 V (b) –9.4 V

(c) –17.8 V (d) +9.4 V

1 1

sin

2

□□□□□□□□

1 3

sin

2

□

□□□□□□□□□

1 2

sin

3

□

□□□□□□□

1 1

sin□□□□□□□□

p n n p

Circuit 1

p n p n

Circuit 2

n p n p

Circuit 3

O T1 T2 T3

t

T4

O T1 T2 T3

t

T4

O T1 T2 T3

t

T4

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23. Ionization energy of a hydrogen-like ion A is greater than that of another hydrogen-

like ion B. Let r, u, E and l represent the radius of the orbit, speed of the electron,

energy of the atom and orbital angular momentum of the electron respectively. In

ground state

(a) rA > rB (b) uA > uB

(c) EA > EB (d) LA > LB

24. Which of the following statements is correct?

(a) The current in a photocell increases with increasing frequency of light

(b) The photo current is proportional to applied voltage

(c) The photo current increases with the increasing intensity of light

(d) The stopping potential increases with increasing intensity of light

25. In figure the input is across the terminals A and C and the output is across B and D.

Then the output is

(a) Zero (b) same as the input

(c) half wave rectified (d) full wave rectified

26. Which of the following curves may represent the speed of the electron in a

hydrogen atom as a function of the principal quantum number n ?

(a) curve a (b) curve b

(c) curve c (d) curve d

Assertion & Reason

(a) Both A and R are true & R is correct explanation of A.

(b) Both A and R are true but R is not correct explanation of A.

(c) A is true but R is false.

(d) Both A and R are false.

27. A: The first focal length f1 and the second focal length f2 of a thin lens are not

always equal.

A

B C

D

n

v

a

d

c

b

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R: Both the focal lengths f1 and f2 of a lens are equal only when the medium on

both the sides of a lens have same refractive index.

28. A: In a resistive ac circuit, current and voltage reaches their maximum value

simultaneously.

R: There is no phase difference between voltage and current in ac resistive circuit.

29. A: Reactance is frequency dependent.

R: In a capacitive ac circuit current lags voltage.

30. A: In one time constant, the current grows to 37% of its maximum value in series

LR circuit.

R: Current growth in series LR circuit is given by

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