Physics - Section A

1.
Which of the following is not due to total internal reflection?

1. Difference between apparent and real depth of the pond
2. Mirage on hot summer days
3. Brilliance of diamond
4. Working of optical fiber

2.

A forward-biased diode is treated as:

1. An open switch with infinite resistance
2. A closed switch with a voltage drop of 0 V
3. A closed switch in series with a battery with voltage of 0.7 V
4. A closed switch in series with small resistance and a battery

3.

α-particle consists of:

1. 2 protons only
2. 2 protons and 2 neutrons only
3. 2 electrons, 2 protons, and 2 neutrons
4. 2 electrons and 4 protons only

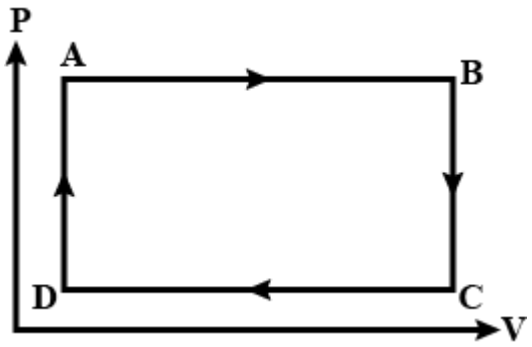
4.

In a transistor, the base is very lightly doped as compared to the emitter because by doing so

1. The flow across the base region is mainly because of electrons
2. The flow across the base region is mainly because of holes
3. Recombination is decreased in the base region
4. Base current is high

5.

The pressure and volume of a gas are changed as shown in the P-V diagram in this figure. The temperature of the gas will:



1. increase as it goes from A to B.
2. increase as it goes from B to C.
3. remain constant during these changes.
4. decrease as it goes from D to A.

6.

Which of the following is not an electromagnetic wave?

1. Radio wave
2. Micro wave
3. Cosmic rays
4. γ-rays

7.

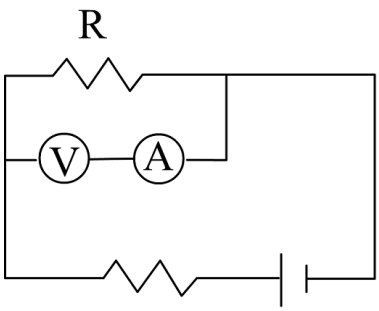
A metallic resistor is connected across a battery. If the number of collisions of free electrons with the lattice is somehow decreased in the resistor (for example cooling it), the current will:

1. Increase
2. Decrease
3. remain the same
4. become zero

8.

Which of the following wiring diagrams can be used to experimentally determine R using Ohm's law? Assume the voltmeter and the ammeter to be ideal.

1.



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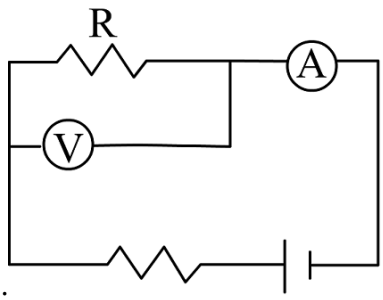

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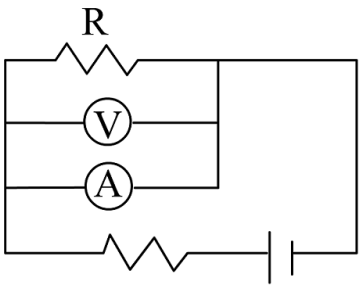

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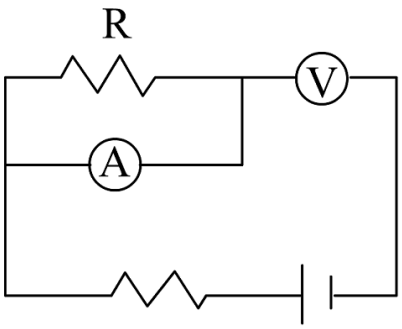
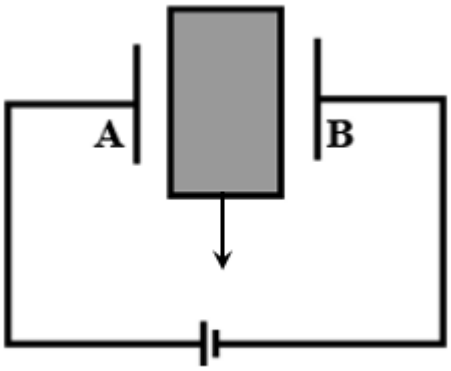


9.

An insulator plate is passed between the plates of a capacitor. Then current:



1. Always flows from A to B
2. Always flows from B to A
3. First flows from A to B and then from B to A
4. First flows from B to A and then from A to B

10.

A direct current is passing through a wire. It is bent to form a coil of one turn. Now it is further bent to form coil of two turns but of smaller radius. The ratio of the magnetic induction at the centre of this coil and at the centre of the coil of one turn is:

1. 1: 4
2. 4: 1
3. 2: 1
4. 1: 1

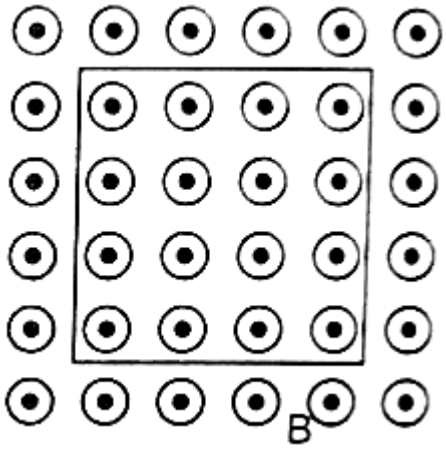
11.

Electrons moving with different speeds enter in uniform magnetic field in a direction perpendicular to the field. If they move along circular paths, then the time periods of rotation will be:

1. same for all electrons
2. greater for the faster electrons
3. smaller for the faster electrons
4. either 2 or 3 depending on the magnitude of the magnetic field

12.

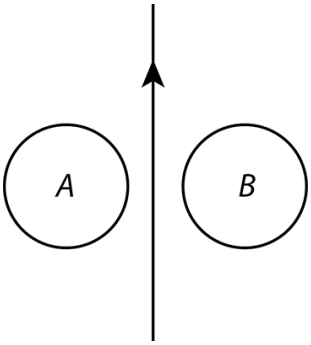
A uniform magnetic field B is directed out of the page. A metallic wire has the shape of a square frame and is placed in the field as shown. While the shape of the wire is steadily transformed into a circle in the same plane, the current in the frame:



1. is directed clockwise
2. does not appear
3. is directed counter clockwise
4. is alternating

13.

A and B are two metallic rings placed at opposite sides of an infinitely long straight conducting wire as shown. If current in the wire is slowly decreased, the direction of the induced current will be :



1. clockwise in A and anticlockwise in B
2. anticlockwise in A and clockwise in B
3. clockwise in both A and B
4. anticlockwise in both A and B

14.

The reactance of a circuit is zero. It is possible that the circuit contains:

1. an inductor and a capacitor
2. an inductor but no capacitor
3. a capacitor but no inductor
4. All of the above

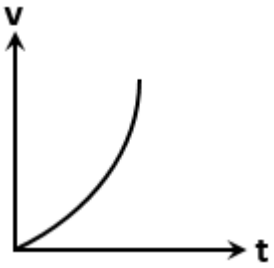
15.

Dimensional analysis cannot be used for:

1. deriving relations
2. deriving relation with four unknown variables
3. converting system of units
4. checking correctness of relations

16.

Figure below shows the velocity-time graph. This graph tells us that the body is:



1. Starting from rest and moving with increasing acceleration
2. Moving with uniform speed.
3. Moving with uniform acceleration.
4. Moving with decreasing acceleration.

17.

If the angle between two forces increases, the magnitude of their resultant:

1. Decreases

2. Increases

3. Remains unchanged

4. First decreases and then increases

18.

A ball is travelling with uniform translatory motion. This means that:

1. It is at rest.

2. The path can be a straight line or circular and the ball travels with uniform speed.

3. All parts of the ball have the same velocity (magnitude and direction) and the velocity is constant.

4. The centre of the ball moves with constant velocity and the ball spins about its centre uniformly.

19.

The potential energy of a system increases if work is done:

1. by the system against a conservative force.

2. by the system against a non-conservative force.

3. upon the system by a conservative force.

4. upon the system by a non-conservative force.

20.

A proton is kept at rest. A positively charged particle is released from rest at a distance S in its field. Consider two experiments; one in which the charged particle is also a proton and in another, a positron. In the same time t, the work done on the two moving charged particles is

1. same as the same force law is involved in the two experiments.

2. less for the case of a positron, as the positron moves away more rapidly and the force on it weakens.

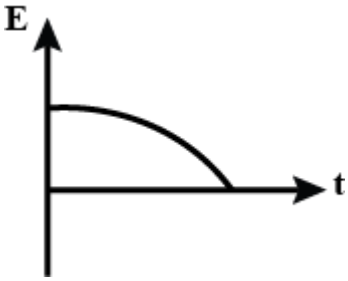
3. more for the case of a positron, as the positron moves a larger distance away.

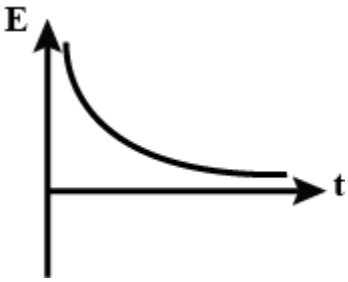
4. same as the work is done by a charged particle on the stationary proton.

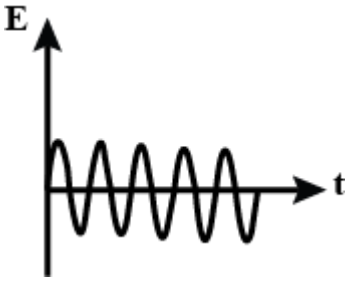
21.

Which of the diagrams represents variation of total mechanical energy of a pendulum oscillating in air as a function of time?

1. 

2. 

3. 

4. 

22.

Internal forces can change:

1. the linear momentum but not the kinetic energy of the system.

2. the kinetic energy but not the linear momentum of the system.

3. linear momentum as well as kinetic energy of the system.

4. neither the linear momentum nor the kinetic energy of the system.

23.

A body projected vertically from the Earth reaches a height equal to the Earth's radius before returning to the Earth. The power exerted by the gravitational force:

1. is the greatest at the instant just before the body hits the Earth.

2. remains constant all through.

3. is the greatest at the instant just after the body is projected.

4. is the greatest at the highest position of the body.

24.

Which one of the following statements is wrong?

1. Young's modulus for a perfectly rigid body is zero.

2. Bulk modulus is relevant for solids, liquids, and gases.

3. Rubber is less elastic than steel.

4. The Young's modulus and shear modulus are relevant for solids.

25.

The wettability of a surface by a liquid depends primarily on:

1. viscosity

2. surface tension

3. density

4. angle of contact between the surface and the liquid

26.

Water is flowing in a horizontal pipe of non-uniform cross-section. At the most contracted place of the pipe:

1. velocity of water will be maximum and pressure minimum.

2. pressure of water will be maximum and velocity minimum.

3. both pressure and velocity of water will be maximum.

4. both pressure and velocity of water will be minimum.

27.

A piece of iron is heated in a flame. If it becomes dull red first, then becomes reddish yellow, and finally turns to white hot, the correct explanation for the above observation is possible by using:

1. Stefan's law

2. Wien's displacement law

3. Kirchhoff's law

4. Newton's law of cooling

28.

Heat is associated with:

1. kinetic energy of random motion of molecules.

2. kinetic energy of orderly motion of molecules.

3. total kinetic energy of random and orderly motion of molecules.

4. kinetic energy of random motion in some cases and kinetic energy of orderly motion in other.

29.

In thermodynamic processes, which of the following statements is not true?

1. In an adiabatic process, the system is insulated from the surroundings.

2. In an isochoric process, pressure remains constant.

3. In an isothermal process, the temperature remains constant.

4. In an adiabatic process, $PV^{\gamma} =$ constant.

30.

If we study the vibration of a pipe open at both ends, which of the following statements is not true?

1. Open end will be an antinode.

2. Odd harmonics of the fundamental frequency will be generated.

3. All harmonics of the fundamental frequency will be generated.

4. Pressure change will be maximum at both ends.

31.

The wavelength of a sound wave in gas is:

1. The distance between compression and rarefaction propagating in the medium.

2. The distance traveled by the wave in one second.

3. The distance between two consecutive particles of the medium oscillating in the same phase.

4. None of the above

32.

A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its focal length will:

(1) Become zero

(2) Become infinite

(3) Become small, but non-zero

(4) Remain unchanged

33.

In which of the following systems will be radius of the first orbit (n = 1) be minimum -

(1) Doubly ionized lithium

(2) Singly ionized helium

(3) Deuterium atom

(4) Hydrogen atom

34.

J.J. Thomson's cathode-ray tube experiment demonstrated that

(1) cathode rays are streams of negatively charged ions

(2) all the mass of an atom is essentially in the nucleus

(3) the e/m of electrons is much greater than the e/m of protons

(4) the e/m ratio of the cathode ray particles changes when a different gas is placed in the discharge tube

35.

One end of the string of length ‘l’ is connected to a particle of mass ‘m’ and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in a circle with speed 'v', the net force on the particle (directed towards the centre) will be: (T represents the tension in the string)

1. $T + \frac{mv^2}{l}$

2. $T - \frac{mv^2}{l}$

3. Zero

4. T

Physics - Section B

36.

Work energy theorem is applicable to a system when the force acting on the system is/are

(1) Conservative only

(2) Non-conservative only

(3) Internal only

(4) All forces

37.

An astronomical refracting telescope will have large angular magnification and high angular resolution when it has an objective lens of:-

1. small focal length and large diameter

2. large focal length and small diameter

3. large focal length and large diameter

4. small focal length and small diameter

38.

Identify the correct definition.

1. If after every certain interval of time, a particle repeats its motion then motion is called periodic motion.

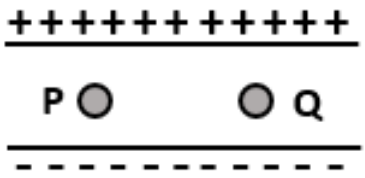
2. To and fro motion of a particle is called oscillatory motion.

3. Oscillatory motion described in terms of single sine and cosine functions is called simple harmonic motion.

4. All of the above

39.

In a Millikan-type experiment, there are two oil droplets P and Q between the charged horizontal plates, as shown in the diagram. Droplet P is in rest while droplet Q is moving upwards. The polarity of the charges on P and Q is



	P	Q
1.	+	+
2.	Neutral	-
3.	-	-
4.	+	-

40.

The power generated across a uniform wire connected across a supply is H. If the wire is cut into n equal parts and all the parts are connected in parallel across the same supply, the total power generated in the wire is:

1. $\frac{H}{n^2}$

2. n^2H

3. nH

4. $\frac{H}{n}$

41.

Two non-ideal batteries are connected in parallel. Consider the following statements:

(A) The equivalent EMF is smaller than either of the two EMFs.

(B) The equivalent internal resistance is smaller than either of the two internal resistances.

1. Both (A) and (B) are correct

2. (A) is correct and (B) is wrong

3. (B) is correct but (A) is wrong

4. Both (A) and (B) are wrong

42.

An isolated metallic sphere of radius R has an electric charge. It is connected by means of a conducting wire to a distant uncharged metallic sphere of radius r (r<R). Which of the following statements is/are correct?

1. Total energy of the system must increase

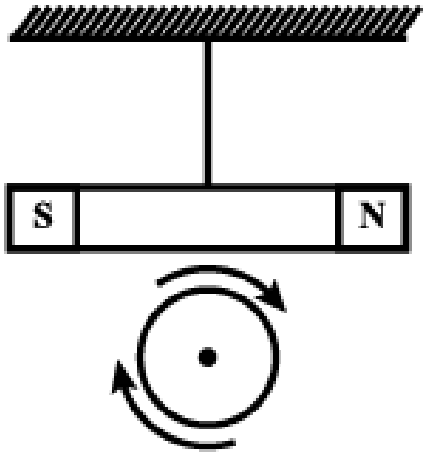
2. Total energy of the system must decrease

3. Final surface charge densities on two spheres may be equal to each other

4. None of these

43.

A negative charge is given to a non-conducting loop and the loop is rotated in the plane of paper about its centre as shown in the figure. The magnetic field produced by the ring affects a small magnet placed above the ring in the same plane such that



1. the magnet does not rotate

2. the magnet rotates clockwise as seen from below

3. the magnet rotates anticlockwise as seen from below

4. no effect on the magnet is there

44.

For a particle performing uniform circular motion, choose the correct statement(s) from the following:

1. Magnitude of particle velocity (speed) remains variable.

2. Particle velocity remains directed parallel to radius vector.

3. Direction of acceleration keeps changing as particle moves.

4. Angular momentum is constant in magnitude but direction keeps changing.

45.

In a cricket match, the fielder draws his hands backward after receiving the ball in order to take a catch because:

1. His hands will be saved from getting hurt.

2. He deceives the player.

3. It is a fashion.

4. He catches the ball firmly.

46.

Choose the incorrect statement.

1. The centre of mass of a two-particle system lies on the line joining the two particles, being closer to the heavier particle

2. In rolling, the point of contact of the rolling body remains at rest relative to the surface on which it is rolling

3. Parallel axis theorem is applicable only for laminar bodies

4. A particle moving on a straight line may have non-zero angular momentum about a point

47.

The total energy of an electron in the n^{th} stationary orbit of the hydrogen atom can be obtained by:

1. $E_n = \frac{13.6}{n^2}\ eV$
2. $E_n = -\frac{13.6}{n^2}\ eV$
3. $E_n = -\frac{1.36}{n^2}\ eV$
4. $E_n = -13.6 \times n^2\ eV$

48.

A tall man of height 6 feet, wants to see his full image. Then required minimum length of the mirror will be :

1. 12 feet
2. 3 feet
3. 6 feet
4. Any length

49.

Zener diode is used as -
1. Half wave rectifier
2. Full wave rectifier
3. A.C. voltage stablizer
4. D.C. voltage stablizer

50.

A nuclear reaction given by

$_{Z}X^{A} \rightarrow_{Z+1} Y^{A} +_{-1} e^{0} + \overline{\nu}$

represents

(1) β-decay

(2) γ-decay

(3) fusion

(4) fission

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