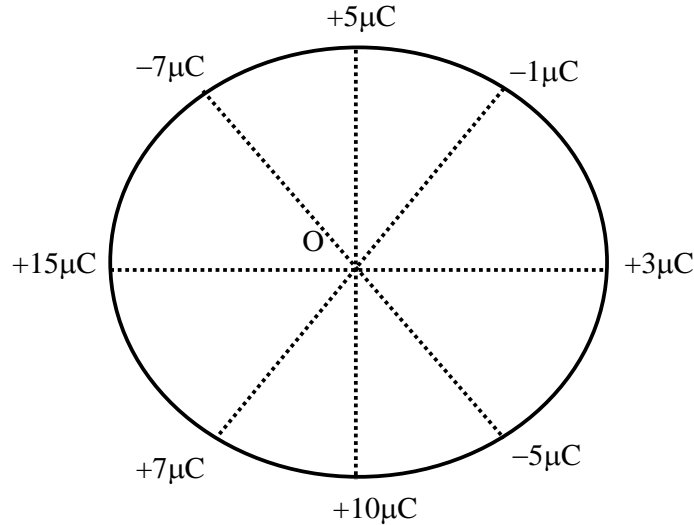
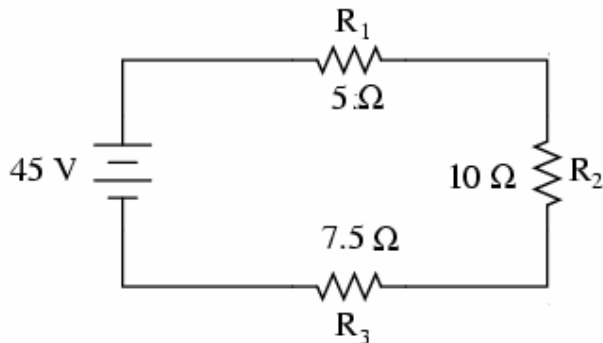


PART I - PHYSICS

1. Eight charges having the values shown in figure are arranged symmetrically on a circle of radius 0.4m in air. The potential at the centre O is

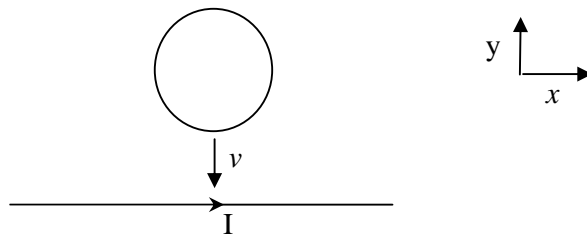


- A) $0.507 \times 10^5 \text{V}$ B) $6.07 \times 10^5 \text{V}$ C) $60.7 \times 10^5 \text{V}$ D) $6.07 \times 10^4 \text{V}$
2. In a gravity free region, a positive test charge is placed with zero velocity near a uniformly charged infinite metal sheet. Which of the following statement is correct?
- A) the test charge will remain at rest
 B) the test charge will move with constant velocity perpendicular to the plane of the sheet
 C) the test charge will move with constant velocity parallel to the plane of the sheet
 D) the test charge will move with constant acceleration
3. In the circuit below



- A) the current through R_1 is lower than the current through R_2
 B) the current through all resistances is equal to 4.5A
 C) the current through R_1 and R_2 is higher than the current through R_3
 D) the current through all resistances is equal to 2A

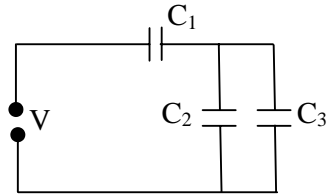
4. If a square loop of side 'a' kept in an uniform magnetic field is gradually changed into a circular loop within time ' t_1 ', then
- A) the induced emf is non-zero only after the time $t > t_1$
 B) the induced emf is non-zero only during the time interval t_1
 C) the induced emf always remains zero
 D) there will be induced emf only if there is a change in the magnetic field
5. In a typical Wheatstone's network, the resistances in cyclic order are $P = 10\Omega$, $Q = 5\Omega$, $R = 4\Omega$ and $S = 4\Omega$. For the bridge to balance
- A) 5 ohm should be connected in parallel with Q
 B) 10 ohm should be connected in series with P
 C) 5 ohm should be connected in series with Q
 D) 4 ohm should be connected in parallel with S
6. A resistance thermometer, which measures temperature measuring the change in resistance of a conductor, is made of platinum and has a resistance of 50Ω at 20°C . When the device is immersed in a vessel containing melting indium, its resistance increases to 76.8Ω at _____. [Given : $\alpha = 3.92 \times 10^{-3} (\text{ }^\circ\text{C}^{-1})$]
- A) 147°C B) 175°C C) 157°C D) 162°C
7. An infinitely long solenoid of radius 2cm is uniformly wound with 1mm diameter copper wire in a single layer. If the current carried by the wire is 0.5A, the magnetic field along the axis is approximately
- A) 500 T B) $6 \times 10^{-7}\text{T}$ C) $6 \times 10^{-4}\text{T}$ D) 1 T
8. A uniform metal ring of area A lying in the x-y plane moves with speed v towards an infinite straight wire carrying current I. Which of the following statement is correct?



- A) an emf will be induced in the ring so that a current is set up in the clockwise direction
 B) an emf will be induced in the ring so that a current is set up in the anticlockwise direction
 C) no emf will be induced in the ring
 D) additional electric charges will be developed on the ring

9. A given length L of a uniform wire is bent (i) into a single circular turn and (ii) into a coil of n identical circular turns. The ratio of the magnetic fields at the center of the coil when same current is passed through them is
- A) $n : 1$ B) $1 : n^2$ C) $n^2 : 1$ D) $1 : n$
10. Unpolarized light is incident upon three polarizers. The first polarizer has a vertical transmission axis, second has a transmission axis rotated 30° with respect to the first and the third has a transmission axis rotated 75° relative to the first. If the initial light intensity of the beam is I_b , calculate the light intensity after the beam passes through the second polarizer.
- A) $\frac{5}{9}I_b$ B) $\frac{3}{7}I_b$ C) $\frac{5}{7}I_b$ D) $\frac{3}{8}I_b$
11. Two coherent sources of intensity ratio 100:1 interfere. The ratio of the intensity between maxima and minima in the pattern is
- A) 1.69 B) 1.49 C) 1.59 D) 1.80
12. A screen is separated from a double slit source by 1.20m. The distance between the two slits is 0.030mm. The second order bright fringe ($m=2$) is measured to be 4.5cm from the centerline. The wavelength of the light is
- A) 593nm B) 690nm C) 563nm D) 840nm
13. If a square loop of side 'a' kept in an uniform magnetic field is gradually changed into a circular loop within time ' t_1 ', then
- A) the induced emf always remains zero
 B) the induced emf is non-zero only during the time interval t_1
 C) the induced emf is non-zero only after the time $t > t_1$
 D) there will be induced emf only if there is a change in the magnetic field
14. In a typical Wheatstone's network, the resistances in cyclic order are $P = 10\Omega$, $Q = 5\Omega$, $R = 4\Omega$ and $S = 4\Omega$. For the bridge to balance
- A) 5 ohm should be connected in parallel with Q
 B) 10 ohm should be connected in series with P
 C) 5 ohm should be connected in series with Q
 D) 4 ohm should be connected in parallel with S

15. A parallel plate capacitor arrangement as shown in figure is connected to a constant voltage source V . When all the capacitors are filled with vacuum, the capacitances are given to be $C_1 = C_2 = C_3 = C$. If the capacitor C_2 is now filled with a medium of dielectric constant $\epsilon_r = \frac{3}{2}$, then the total capacitance of the circuit is



- A) $\frac{7}{5}C$ B) $\frac{3}{2}C$ C) $\frac{2}{3}C$ D) $\frac{5}{7}C$
16. An AC generator consists of eight turns of wire, each having area $A=0.009\text{m}^2$, with a total resistance of 12Ω . The loop rotates in a magnetic field of 0.5T at a constant frequency of 60Hz . The maximum induced emf is
- A) 134V B) 127V C) 136V D) 143V
17. The magnetic flux through a coil perpendicular to its plane is varying according to the relation: $\phi = [4t^3 + 5t^2 + 8t + 5]$ weber. If the resistance of the coil is 3.1Ω , the induced current through the coil at $t = 2\text{s}$ is
- A) 2.452A B) 2.859A C) 28.59A D) 24.52A
18. When a hydrogen atom makes a transition from $n = 3$ to $n = 2$ state the wavelength emitted for the first Balmer line is
- A) 706nm B) 840nm C) 658nm D) 690nm
19. In Ruby Laser the output is
- A) a continuous mode of wavelength 5934\AA B) an intense pulse of wavelength 6934\AA
 C) a continuous mode of wavelength 6934\AA D) an intense pulse of wavelength 5934\AA
20. Hologram is the resultant of not only the amplitude distribution but also the phase of the object wave. It works based on the principle of
- A) diffraction B) total internal reflection
 C) interference D) polarization