



Answer the following questions:

Useful data:  $q_e = 1.6022 \times 10^{-19} \text{ C}$ ,  $m_e = 9.1 \times 10^{-31} \text{ kg}$ ,  $K_e = 9 \times 10^9 \text{ N.m}^2/\text{C}^2$

**Question(1) : (ILOs: a1)**

**(15 Marks)**

(a) What are the SI Units of the constant G?  $F = G \frac{MM}{r^2}$

F: force, M:mass, r: distance

(b) A car is traveling at a speed of 25m/s. What is the speed in Km/h?

(c) A particle moves in a circular path with constant speed. The rate of rotation is 7 cycle per second. Find the angular velocity ( $\omega$ ) of the particle.

**Question(2) : (ILOs: a1,b1)**

**(15 Marks)**

(a) What is the moment of inertia of a 2kg long uniform rod with length of 2m. The axis of rotation is located at the center of rod.

(b) The period of a simple pendulum (T) depends only on the length of the string(L) and the acceleration due to gravity (g). Find an equation for the period (T).

(c) A 200Kg load is hung on a wire of length of 6m, cross section area  $0.2 \times 10^{-4} \text{ m}^2$  and Young's modulus  $8 \times 10^{10} \text{ N/m}^2$ . What is the increase of length? ( $g=9.8 \text{ m/s}^2$ )

**Question(3) : (ILOs: b1)**

**(15 Marks)**

(a) A large storage tank open at the top and filled with water, there is a small hole in its side at a point 10m below the water level. Determine the speed at which the water leaves the hole. ( $g=9.8 \text{ m/s}^2$ )

(b) Light is traveling from glass ( $n_1=1.5$ ) to air( $n_2=1$ ). If the angle of incidence is  $30^\circ$  Determine the value for the angle of refraction.

(c) An object is placed 25cm from a convex lens of focal length 30cm. Draw a ray diagram to show the position and type of the image.

**Question(4) : (ILOs: a2)**

**(15 Marks)**

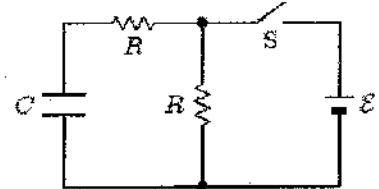
(a) Choose the best answer:

1- A 120V power line is protected by a 15A fuse. What is the maximum number of "120V, 500W" light bulbs that can be operated at full brightness from this line?

- A. 1                      B. 2                      C. 3                      D. 4                      E. 5

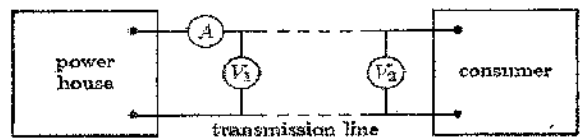
2- In the circuit shown, both resistors have the same value R. Suppose switch S is initially closed. When it is then opened, the circuit has a time constant  $\tau_a$ . Conversely, suppose S is initially open. When it is then closed, the circuit has a time constant  $\tau_b$ . The ratio  $\tau_a/\tau_b$  is:

- A. 1                      B. 2                      C. 0.5                      D. 0.667                      E. 1.5



3- In the figure, voltmeter V1 reads 600V, voltmeter V2 reads 580V, and ammeter A reads 100A. The power wasted in the transmission line connecting the power house to the consumer is:

- A. 1 kW                      B. 2 kW                      C. 58kW  
D. 59 kW                      E. 60kW



4- A total resistance of  $3\Omega$  is to be produced by combining an unknown resistor R with a  $12\Omega$  resistor. What is the value of R and how is it to be connected to the  $12\Omega$  resistor?

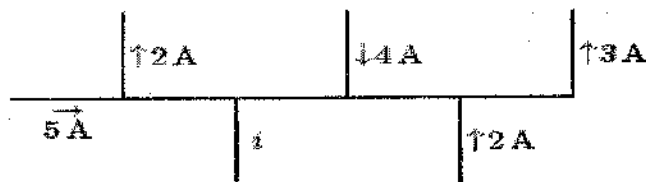
- A.  $4\Omega$ , parallel                      B.  $4\Omega$ , series                      C.  $2.4\Omega$ , parallel                      D.  $2.4\Omega$ , series                      E.  $9\Omega$ , series

5- A 120V power line is protected by a 15A fuse. What is the maximum number of "120V, 500W" light bulbs that can be operated at full brightness from this line?

- A. 1                      B. 2                      C. 3                      D. 4                      E. 5

6- A portion of a circuit is shown, with the values of the currents given for some branches. What is the direction and value of the current i?

- A.  $\downarrow$ , 6 A                      B.  $\uparrow$ , 6 A  
C.  $\downarrow$ , 4 A                      D.  $\uparrow$ , 4 A  
E.  $\downarrow$ , 2 A



7-Suppose the electric company charges 10 cents per kW.h. How much does it cost to use a 125W lamp 4 hours a day for 30 days?

- A. \$1.2                      B. \$1.5                      C. \$1.8                      D. \$7.2                      E. none of these

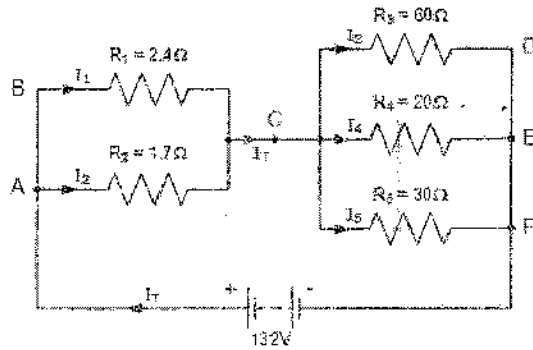
8- Equipotential surfaces associated with an electric dipole are:

- A. spheres centered on the dipole                      B. cylinders with axes along the dipole moment  
C. planes perpendicular to the dipole moment                      D. planes parallel to the dipole moment  
E. none of the above

9- Two capacitors are identical except that one is filled with air and the other with oil. Both capacitors carry the same charge. The ratio of the electric fields  $E_{air}/E_{oil}$  is:

- A. between 0 and 1                      B. 0                      C. 1                      D. between 1 and infinity                      E. infinite

(b) Find current in each resistor by two different methods



**Question(5) : (ILOs: b2)**

**(15 Marks)**

(a) Check the errors for the following statements and correct it if exist.

- 1- If both the plate area and the plate separation of a parallel-plate capacitor are doubled, the capacitance is doubled.
- 2- A cylindrical copper rod has resistance R. It is reformed to twice its original length with no change of volume. Its new resistance is R.
- 3- Gauss' law applies to a closed surface of any shape
- 4- An electron traveling north enters a region where the electric field is uniform and points north. The electron speeds up.
- 5- Electric field lines form closed loops.
- 6- Gauss' law can be used to find the electric flux through a pyramid.

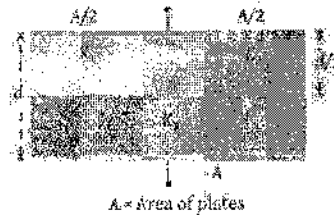
(b) Start from Gauss' law find the capacitance of spherical capacitor.

(c) Discuss the properties of metals.

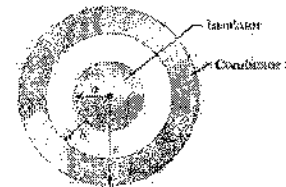
**Question(6) : (ILOs: c2)**

**(15 Marks)**

(a) Find the capacitance of the following capacitor.



(b) A solid insulating sphere of radius a carries a net positive charge 3Q, uniformly distributed throughout its volume. Concentric with this sphere is a conducting spherical shell with inner radius b and outer radius c, and having a net charge -Q, as shown in the Figure. Find the electric field everywhere.



(c) Suppose the electric potential due to a certain charge distribution can be written in Cartesian

Coordinates as:  $V(x, y, z) = Ax^2 + By^2 + Cz^2$

Where A, B and C are constants. What is the associated electric field?

(d) How the microwave ovens work?

**Best Wishes**

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