



Answer the following questions:

Question(1) : (ILOs: a2)

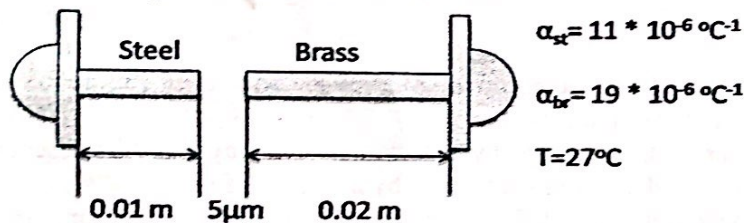
(15Marks)

- (a) The temperature is (59°F). What is the temperature in (°C) and in (K)?
- (b) What is the meaning of “Thermal equilibrium“?
- (c) The energy transfer mechanisms are: 1)..... 2)..... 3)..... (complete)

Question(2) : (ILOs: a2)

(15 Marks)

- (a) At what temperature will the bolts touch?



- (b) A (0.05 Kg) ingot of metal is heated to (200°C) and then dropped into a calorimeter containing (0.4 Kg) of water initially at (20°C). The final equilibrium temperature of the mixed system is (22.4°C). Find the specific heat of the metal. [$C_w = 4168 \text{ J/Kg.}^\circ\text{C}$]

- (c) The energy input to an engine is 4 times greater than the work it performs. What is its thermal efficiency?

Question(3) : (ILOs: b2)

(15 Marks)

A (739 cm³) cylinder contains (3 mol) of helium gas at a temperature of (300 K). Assume the helium behaves like an ideal gas : [$R = 8.314 \text{ J/mol.K}$]

- (a) What is the pressure of the gas?
- (b) What is the total kinetic energy of the gas molecules?
- (c) How much energy must be transferred by heat to the gas at constant pressure to raise the temperature to (500 K)?

Question(4) : (ILOs: a2)

(15Marks)

(a) Choose the best answer:

1-Magnetic permeability has units as

- (a) Wb / m^2 (b) $\text{Wb} / \text{A.m}$ (c) A / m (d) Tesla / m

2-A proton moves in a circle of radius R at speed v in a magnetic field of strength B . If we want an alpha particle (2 neutrons + 2 protons) to move in a circle of the same radius in the same magnetic field, what speed should it have? For this question, assume that the mass of an alpha particle is exactly four times the mass of a proton.

- (a) $v/4$. (b) $v/2$. (c) v . (d) $2v$. (e) $4v$.

3-A positively charged object is placed in the center of a room with a uniform magnetic field. If the magnetic field is pointing east the object will

- a) move east. b) move west. c) move north. d) move south. e) not move.

(b) Two long parallel wires 20 cm apart carry currents of 5A and 8A in the same direction. Is there any point between the two wires where the magnetic field is zero?

(c) Discuss how to separate two isotopes.

Question(5) : (ILOs: b2)

(15 Marks)

(a) Choose the best answer:

1-An inductor and resistor are connected in series to an AC voltage source. If you double the frequency of the voltage the effect on the inductor is to

- a) double its reactance b) increase its reactance by a factor of four c) leave its reactance unchanged d) halve its reactance e) decrease its reactance by a factor of four

2-A solenoid consists of 1000 windings and is 0.5 cm long. A current of 2 amps is supplied to the windings. What is the magnitude of magnetic field

- a) 0.3 T b) 0.1 T c) 0.67 T d.) 0.50 T e) None of the above.

3-A coil of 200 turns of wire has a cross sectional area of 0.2 square meters. A current of 4 amps run through the loops of wire. The coil is located in a constant magnetic field of 3 Tesla. What is the magnitude of the maximum torque on the coil of wire?

- a) 240Nm b) 480 Nm c) 628 Nm d) 633 Nm e) None of the above.

(b) Starting from Ampere's law find the self inductance of a toroid of rectangular cross section, with inner radius a , outer radius b and height h .

(c) Consider the circuit shown in the Figure.

Determine the current through each resistor

(i)immediately after the switch is closed.

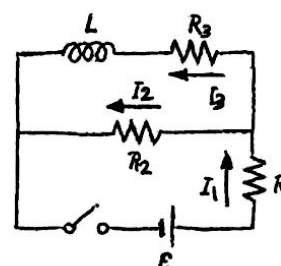
(ii)a long time after the switch is closed.

Suppose the switch is reopened a long time after it's been closed.

What is each current

(iii)immediately after it is opened?

(iv)after a long time?



Question(6) : (ILOs: b2)

(15 Marks)

(a) Choose the best answer:

1-The magnetic field B inside a long ideal solenoid is independent of:

- A) the current B) the core material C) the spacing of the windings D) the cross-sectional area of the solenoid E) the direction of the current

2-If the magnetic flux through a certain region is changing with time:

- A) Energy must be dissipated as heat
B) An electric field must exist at the boundary
C) A current must flow around the boundary
D) An emf must exist around the boundary
E) A magnetic field must exist at the boundary

3-Magnetic permeability has units as

- A) Tesla B) Henry C) Tesla / m D) Henry / m

(b) An AC voltage source is connected to a “black box” which contains a circuit, as shown in the Figure.

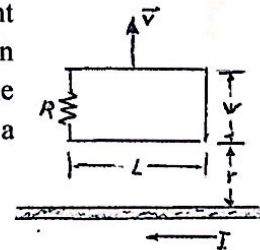
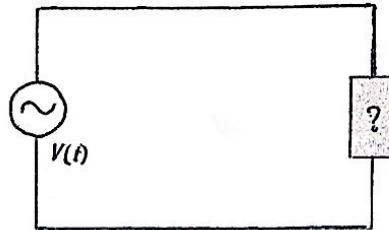
The elements in the circuit and their arrangement, however, are unknown. Measurements outside the black box provide the following information:

$$V(t) = (80 \text{ V}) \sin \omega t$$

$$I(t) = (1.6 \text{ A}) \sin(\omega t + 45^\circ)$$

- (1) Does the current lead or lag the voltage?
(2) Is the circuit in the black box largely capacitive or inductive?
(3) Is the circuit in the black box at resonance?
(4) What is the power factor?
(5) Does the box contain a resistor? A capacitor? An inductor?
(6) Compute the average power delivered to the black box by the AC source.

(c) A rectangular loop of dimensions l and w moves with a constant velocity v away from an infinitely long straight wire carrying a current I in the plane of the loop, as shown in Figure. Let the total resistance of the loop be R . What is the current in the loop at the instant the near side is a distance r from the wire?



(d) How cyclotron works?

Useful data : $q_e = 1.6022 \times 10^{-19}$, $m_e = 9.1 \times 10^{-31}$, $\mu_0 = 4\pi \times 10^{-7}$. All in S.I units

Assume any missing data

Best Wishes

Dr. Ahmed Saeed

Dr. Demyana Adel Abdel Masieh