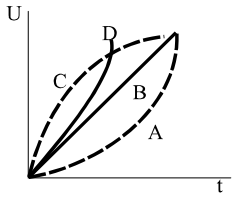
OBJECTIVE - I

1. Which of the following plots may represent the thermal energy produced in a resistor in a given time as a function of the electric current ?



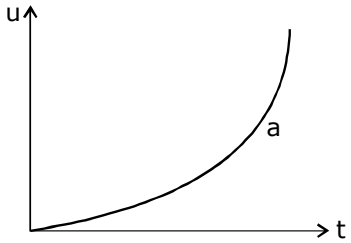
(A*) 1 (B) 2 (C) 3 (D) 4

Sol. **A**

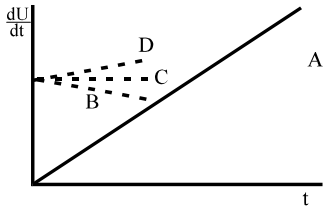
$$U_{AB} = O_{AB}\, q + \frac{1}{2} b_{AB}\, \theta^2$$

$$\theta \propto t$$

$$U_{AB} \propto a_{AB}\, t + \frac{1}{2} b_{AB}\, t^2$$

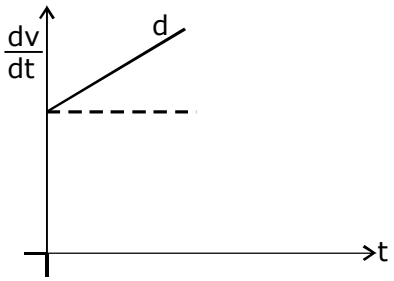


2. A constant current i is passed through a resistor. Taking the temperature coefficient of resistance into account, indicate which of the plots shown in fig. best represents the rate of production of thermal energy in the resistor.



(A) 1 (B) 2 (C) 3 (D*) 4

Sol. **A**



$$U_{AB} = a_{AB}\, \theta + \frac{1}{2} b_{AB}\, \theta^2$$

$q \times t$

$dq \times dt$

Þ $\dfrac{du_{AB}}{dt} \propto a_{AB} + b_{AB}\, t$

3. Consider the following statements regarding a thermocouple.

(a) The neutral temperature does not depend on the temperature of the cold junction.

(b) The inversion temperature does not depend on the temperature of the cold junction.

(A) Both a and b are correct. (B*) a is correct but b is worng

(C) b is correct but a is wrong (D) Both a and b are wrong

Sol. B

At cold function :-

$Q_n - Q_C = Q_i - Q_n$

where Q_n Þ neutral temperture

Q_i Þ inversion temperature

Q_c Þ thermo-couple temperature.

Þ The neutral temperature does not depend on the temperature of the cold function.

Þ The inversion temperature does depend on the temperature of the cold function.

4. The heat developed in a system is propertional to the current through it.

(A) It cannot be Thomson heat (B) It cannot be Peltier heat

(C*) It cannot be Joule heat (D) It can be any of the three heats mentioned above

Sol. C

5. Consider the following two statements

(a) Free-electron density is different in different metals.

(b) Free-electron density in a metal depends on temperature.

Seebeck effect is caused

(A*) due to both a and b (B) due to a but not due to b

(C) due to b but not due to a (D) neither due to a nor due to b

Ans. A

See back effect is caused due to free electron density is different in different metals or free-electron density in a metal depends on temperature.

6. Consider the statement a and b in the previous question. Peltier effect is caused

(A) due to both a and b (B*) due to a but not due to b

(C) due to b but not due to a (D) neither due to a nor due to b

Sol. B

Pelties effect is caused due to free electron density is different in different metals.

7. Consider the statements a and b in question 5. Thomson effect is caused

(A) due to both a and b (B) due to a but not due to b

(C*) due to b but not due to a (D) neither due to a nor due to b

Sol. C

Thomson effect is caused due to free electron density in a metal depends on temperature.

8. Faraday constant :

(A) depends on the amount of the electrolyte

(B) depends on the current in the electrolyte

(C*) is a universal constant

(D) depends on the amount of charge passed through the electrolyte.

Sol. C

Faraday constant is universal constant.

OBJECTIVE - II

1. Two resistors having equal resistance are joined in series and current is passed through the combination. Negect any variation is resistance as the temperature changes. In a given time interval,

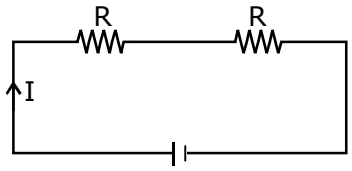
(A*) equal amounts of thermal energy must be produced in the resistors

(B) unequal amounts of thermal energy may be produced

(C) the temperature must rise equally in the resistors

(D*) the tepmerature may rise equally in the resistors

Sol. **AD**



$H = I^2Rt$

Þ Equal amount of thermal energy must be produced in the resistors.

Þ The temperature may rise equally in the resistors.

2. A copper strip AB and an iron strip AC are joined at A. The junction A is maintained at 0°C and the free ends B and C are maintained at 100°C. There is potential different between

(A*) the two ends of the copper strip (B*) the copper end and the iron end at the junction

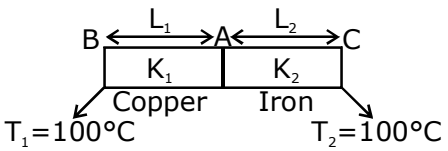
(C*) the two ends of the iron strip (D*) the free ends B and C

Sol. **ABCD**

In steady state the rate of flow of that in both rods in the same.

Þ $\left(\frac{Q}{t}\right)_1 = \left(\frac{Q}{t}\right)_2$

$$\frac{K_1A(T_1 - T)}{L_1} = \frac{K_2A(T - T_2)}{L_2}$$



"K, K_2 is the conductivity of the metals."

So potential is different in different end (Because conductivity of metals are different)

3. The constance a and b for the pair silver-lead are 2.50 mV/°C and 0.012 mV/°$(C)^2$ respectively. For a silver-lead thermocouple with colder junction at 0°C,

(A*) there will be no neutral temperature

(B*) there will be no inversion temperature

(C) there will not be any thermo-emf even if the junctions are kept at different temperatures

(D) there will no current in the thermocouple even if the junction are kept at different temperature.

Sol. AB

There will be no neutral temperature.

There will be no inversion temperature.

4. An electrolysis experiment is stopped and the battery terminals are reversed.

(A) The electrolysis will stop

(B) The rate of liberation of material at the electrodes will increased.

(C*) The rate of liberation of material will remain the same

(D) Heat will be produce at a greater rate

Sol. **C**

An electrolysis experiment is stopped and the battery terminals are reversed. But the rate of liberation of meterial will remain the same.

5. The electrochemical equivalent of a material depends on
(A*) the nature of the material
(B) the current through the electrolyte containing the material
(C) the amount of charge passed through the electrolyte
(D) the amount of this material present in the electrolyte.

Sol. **A**
The electro chemical equivalent of a material depends on the nature of the material.
Electro chemical equivalent of a substance is equal to its relative atomic mass divided by its valency.