THERMO ELECTRICITY

PREVIOUS EAMCET BITS

1. **Assertion (A)** : Duddell's thermo-galvanometer can be used to measure alternating current and direct currents

   Reason (R) : Heat produced in a resistance does not depend on direction of current

   1) Both A and R are true but R is the correct explanation of A

   2) Both A and R are true but R is not the correct explanation of A

   3) A is true but R is false

   4) A is false but R is true **[EAMCET 2004 M]**

   Ans : 1

Sol:

2. **Assertion (A)** : Rapidly changing temperature can be measured by thermocouples

   Reason (R) : The thermal capacity of the junction of thermocouple is very small

   1) Both A and R are true but R is the correct explanation of A

   2) Both A and R are true but R is not the correct explanation of A

   3) A is true but R is false

   4) A is false but R is true **[EAMCET 2004 E]**

   Ans : 1

Sol:

3. The thermo e.m.f produced in a thermocouple is 3 microvolts per degree centigrade. If the temperature of the cold junction is 20°C and the thermo e.m.f is 0.3 millivolt, the temperature of the hot junction is **[EAMCET 2003 M]**

   1) 80°C 2) 100°C 3) 120°C 4) 140°

   Ans : 3

Sol: $T - 20 = \frac{EMF}{EMF/°C}$

$\frac{0.3 \times 10^{-3}}{3 \times 10^{-6}} = 100$

$\Rightarrow T = 120°C$

4. Consider the two following statements A and B and identify the correct choice given in the answer **[EAMCET 2003 E]**

   A) Duddell's thermo-galvanometer is suitable to measure direct current only

   B) thermopile can measure temperature differences of the order of 10^{-3}°C

   1) Both A and B are correct 2) Both A and B are false

   3) A is true but B is false 4) A is false but B is true

   Ans : 4

Sol:

5. The cold junction of a thermocouple is at 0°C. The thermo e.m.f produced in the thermocouple is given by an equation $E = 16T - 0.04T^2$, where T is the temperature of the hot junction. The temperature of inversion and neutral temperature of the thermocouple **[EAMCET 2002 E]**

1) 200°C, 400°C 2) 400°C, 200°C 3) 200°C,300°C 4) 300°C, 200°C

Ans : 2

Sol: $E = 16T - 0.04T^2 = T(16 - 0.04T) = 0$

For inversion temperature

$$T_i = \frac{16}{0.04} = 400°C$$

$$T_N = \frac{T_i}{2} = 200°C$$

6. The value of Peltier coefficient of a thermo couple **[EAMCET 2002 M]**

1) does not vary with absolute temperature of the junction

2) varies with absolute temperature of the junction

3) does not depend on the two different metals forming the junction

4) varies with the direction of current

Ans : 2

Sol:

7. Peltier effect is the converse of **[EAMCET 2001 M]**

1) Thomson effect 2) Flemings left hand rule

3) Lenz's law 4) Seebeck effect

Ans : 4

Sol:

8. Thomson coefficient of a conductor is 10mV/K. Then two ends of it are kept at 50°C and 60°C respectively. Amount of heat absorbed by the conductor when a charge of 10 coulomb flows through it is **[EAMCET 2001 E]**

1) 1000 J 2) 100 J 3) 100 mJ 4) 1 mJ

Ans : 4

Sol: Heat absorbed = $\sigma q \Delta K$

$= 10 \times 10^{-6} \times 10 \times (60 - 50)$

$= 10^{-3} J = 1mJ$

9. Consider the following statements (A) and (B) and identify the correct answers given below:

A) Peltier coefficient is numerically equal to the potential difference across the junctions of the thermocouple through which current is flowing **[EAMCET 2005 E]**

B) According to the Thomson, energy is neither absorbed nor evolved at the junction of thermocouple but is absorbed or evolved only along the lengths of both conductors.

1) Both A and B are true 2) Both A and B are false

3) A is true but B is false 4) A is false but B is true

Ans : 3

Sol: A is true B is false

10. The hot and cold juncitons of iron – platinum and constantan –plantinum thermocouples, when held at a temperature difference of 100°C generate thermo e.m.f of 1600 V and 340μV respectively. The value of thermo e.mf for iron-constant thermocouple (in $\mu V °C^{-1}$) is

[EAMCET 2005 M]

1) 14 2) 25 3) 28 4) 50

Ans : 4

Sol: ${}_{Fe}e^{constant} = {}_{Fe}e^{Pla.} + {}_{Pla}e^{const.}$

$= 1600 + 3400 = 5400\mu V$

Thermo emf per one °C = $50\mu V/°C$

11. If the cold junction is held at 0°C, the thermo e.m.f 'V' of a thermocouple varies as $V = 10\times10^{-6}t - \frac{1}{40}\times10^{-6}t$, where 't' is the temperature of the hot junction in 0°C. The neutral temperature and the maximum value of thermo e.m.f are respectively **[EAMCET 2006 E]**

1) 200°C, 2mV 2) 400°C, 2mV 3) 100°C, 1mV 4) 200°C, 1mV

Ans : 4

Sol: $V = 10\times10^{-6}t - \frac{1}{40}\times10^{-6}t^2$

$a = 10^{-5};\ b = \frac{10^{-6}}{40}$

Neutral temp.

$T_n = \frac{a}{2b} = \frac{10^{-5}}{10^{-6}}\times\frac{40}{2} = 200°C$

$V_{max} = 10^{-5}\times200 - \frac{10^{-6}}{40}\times4\times10^4 = 2\times10^{-3} - 10^{-3} = 1mv$

Hence (4) is the correct choice

12. Consider the following two statements A and B an identify the correct answer

A : Constantan – Copper thermocouple is generally used to measure temperatures upto 1600°C

B: In an iron-copper thermocouple, current flows from iron to copper through cold junction

[EAMCET 2006 M]

1) Both A and B are true 2) Both A and B are false

3) A is true but B is false 4) A is false but B is true

Ans : 4

Sol:

13. Temperature of cold function in a thermocouple is 10°C and neutral temperature is 270°C, then the temperature of inversion is found to be 540°C. Then the neutral temperature is

[EAMCET 2007 E]

1) 540°C 2) 530°C 3) 280°C 4) 360°C

Ans : 2

Sol: $T_n - T_c = T_i - T_n \Rightarrow 270 - 10 = T_i - 270$

$T_i = 530°$

14. In a thermo-couple the cold junction is at 30°C. The temperature of inversion is found to be 540°C. Then the neutral temperature is **[EAMCET 2007 M]**

1) 270°C 2) 510°C 3) 285°C 4) 240°C

Ans : 3

Sol: $T_n - T_c = T_i - T_n \Rightarrow 2T_n = T_c + T_i$

$$T_n = \frac{T_c + T_i}{2} = \frac{540 + 30}{2} = 285°C$$