CBSE

THERMAL PROPERTIES OF MATTER WS 8

Class 11 - Physics

Section A

1. A beaker full of hot water is kept in a room. If it cools from 80 °C to 75 °C in t_1 minutes, from 75 °C to 70 °C in t_2 minutes and from 70 °C to 65 °C in t_3 minutes, then **[1]**

   a) $t_1 > t_2 > t_3$ b) $t_1 = t_2 = t_3$

   c) $t_1 < t_2 = t_3$ d) $t_1 < t_2 < t_3$

2. A body cools from 80°C to 64°C in 5 minutes and same body cools from 80°C to 52°C in 10 minutes. What is the temperature of surrounding? **[1]**

   a) 22°C b) 24°C

   c) 25°C d) 28°C

3. The rate of cooling due to conduction, convection, and radiation combined, is proportional to the difference in temperature, for **[1]**

   a) any temperature difference b) large temperature differences

   c) small temperature differences d) No temperature differences

4. The sprinkling of water reduces slightly the temperature of a closed room because **[1]**

   a) water is a bad conductor of heat b) water has large latent heat of vaporisation

   c) specific heat of water is high d) temperature of water is less than that of the room

5. Certain quantity of water cools from 70°C to 60 °C in the first 5 minutes and to 54 °C in the next 5 minutes. The temperature of the surroundings is **[1]**

   a) 10°C b) 42°C

   c) 20°C d) 45°C

6. If T_1 is the temperature of the surrounding medium and T_2 is the temperature of the body, then according to Newton's Law of Cooling, rate of cooling of the body is: **[1]**

   a) $\frac{dQ}{dt} = k({T_2}^2 + {T_1}^2)$ b) $\frac{dQ}{dt} = k({T_2}^2 - {T_1}^2)$

   c) $\frac{dQ}{dt} = -k(T_2 - T_1)$ d) $\frac{dQ}{dt} = -k(T_2 + T_1)$

7. A body cools from 80 ^{o}C to 50 ^{o}C in 5 minutes. Calculate the time it takes to cool from 60 ^{o}C to 30 ^{o}C. The temperature of the surroundings is 20 ^{o}C. **[1]**

   a) 12 min b) 9 min

   c) 15 min d) 6 min

8. Rate of cooling at 600 K, if surrounding temperature is 300 K is R. The rate of cooling at 900 K is **[1]**

a) $\frac{16}{3}R$ b) 3R

c) 2R d) $\frac{2}{3}R$

9. **Assertion:** A sphere, a cube and a thin circular plate made of same material and of same mass are initially heated to 200°C, the plate will cool at fastest rate. **[1]**

Reason: Rate of cooling = $\frac{eA\sigma}{ms}\left(T^4 - T_0^4\right) \propto$ surface area and surface area is maximum for plate.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

10. **Assertion:** Coolant coils are fitted at the top of a refrigerator, for formation of convection current. **[1]**

Reason: Air becomes denser on cooling.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

11. **State True or False:** **[1]**

(a) A sphere, a cube and a thin circular plate, all made of the same material and having the same mass are initially heated to a temperature of 200°C When left in air at room temperature, the rate of cooling is maximum for the plate and minimum for the sphere. **[1]**

12. **Fill in the blanks:** **[1]**

(a) The rate of cooling of a body is _____ proportional to the temperature difference between the body and its surroundings, provided the temperature difference is _____. **[1]**

13. If a hot body is kept in surroundings which are cooler than the body, only the hot body radiates heat, while the cooler surroundings do not? Is it true or false? **[1]**

14. Which object will cool faster when kept in the open air, the one at 300°C or the one of 100°C? Why? **[1]**

15. State Newton's law of cooling. Deduce the relations : **[1]**

$\log_e(T - T_0) = -kf + c$

and $\Delta T = T - T_0 = Ce^{-kt}$

where the symbols have their usual meanings. Represent Newton's law of cooling graphically by using each of the above equations.

Section B

16. State and give mathematical expressions for **[2]**

i. Newton's law of cooling

ii. Stefan's law of black body radiation.

17. A body at temperature 94°C cools to 86°C in 2 min. What time will it take to cool from 82°C to 78°C? The temperature of surrounding is 20°C. **[2]**

18. A body cools in 7 minutes from 60° C to 40° C. What will be its temperature after the next 7 minutes? The **[2]**

temperature of the surroundings is 10°C. Assume that Newton's law of cooling holds good throughout the process.

19. Calculate the rate of loss of heat through a glass window of area 1000 cm^2 and thickness 0.4 cm. When temperature inside is 37^oC and outside is -5^oC. Coefficient of thermal conductivity of glass is 2.2×10^{-3} cal s^{-1} cm^{-1} K^{-1}. **[2]**

20. Two bodies A and B are kept in evacuated vessels maintained at a temperature of 27°C. The temperature of A is 527°C and that of B is 127°. Compare the rates at which heat is lost from A and B. **[2]**

21. How much faster does a cup of coffee cool off by one degree from 100^o C than from 30^o C in a room at 20^o C? Assume the coffee to act as a black body. **[2]**

22. State Stefan's Law and Newton's Law of cooling. How do you deduce the later from the former? **[2]**

Section C

23. Give the Newton's law of cooling. Derive Newton's law of cooling using Stefan's law. **[3]**

24. From Newton's law of cooling show that temperature of a hot liquid, when allowed to cool, falls exponentially. **[3]**

Section D

25. State Newton's law of cooling. Express it mathematically. How can this law be verified experimentally? **[5]**

26. A body cools from 80 °C to 50 °C in 5 minutes. Calculate the time it takes to cool from 60 °C to 30 °C. The temperature of the surroundings is 20 °C. **[5]**

27. State Newton's law of cooling and explain experimental verification of Newton's law of cooling. **[5]**