PrSh-01- CALORIMETRY-THERMAL PHYSICS-L-1

1. A lead bullet penetrates into a solid object and melts. Assuming that 40% of its kinetic energy is used to heat it, the initial speed of bullet is:

   (Given, initial temperature of the bullet = 127^{o}C, Melting point of the bullet = 327^{o}C, Latent heat of fusion of lead = 2.5 $\times$ 10^{4} J Kg^{-1}, Specific heat capacity of lead - 125J/kg K)

   a) 125 ms^{-1} b) 250 ms^{-1}

   c) 600 ms^{-1} d) 500 ms^{-1}

2. Ice at -20°C is added to 50 g of water at 40°C, when the temperature of the mixture reaches 0°C, it is found that 20 g of ice is still unmelted. The amount of ice added to the water was close to:
   (Specific heat of water = 4.2 J/g/°C
   Specific heat of Ice = 2.1 J/g/°C
   Heat of fusion of water at 0°C = 334 J/g)

   a) 100g b) 60g

   c) 40g d) 50g

3. Two identical blocks of ice move in opposite directions with equal speed and collide with each other. What will be the minimum speed required to make both the blocks melt completely, if the initial temperatures of the blocks were -8 °C each?

   (Specific heat of ice is 2100 Jkg^{-1} K^{-1} and Latent heat of fusion of ice is 3.36 $\times$ 10^{5} Jkg^{-1})

   a) 840 ms^{-1} b) 84 ms^{-1}

   c) 420 ms^{-1} d) 8.4 ms^{-1}

4. The temperature of equal masses of three different liquids x, y and z are 10^{o}C, 20^{o}C and 30^{o}C respectively. The temperature of mixture when x is mixed with y is 16^{o}C and that when y is mixed with z is 26^{o}C. The temperature of mixture when x and z are mixed will be:

   a) 20.28^{o}C b) 28.32^{o}C

   c) 23.84^{o}C d) 25.62^{o}C

5. A mass of 50g of water in a closed vessel, with surroundings at a constant temperature takes 2 minutes to cool from 30°C to 25°C. A mass of 100 g of another liquid in an identical vessel with identical surroundings takes the same time to cool from 30° C to 25° C. The specific heat of the liquid is:
   (The water equivalent of the vessel is 30g.)

   a) 0.5 kcal/kg b) 2.0 kcal/kg

c) 3 kcal/kg

d) 7 kcal/kg

6. Heat energy of 184 kJ is given to ice of mass 600 g at -12^{o}C, Specific heat of ice is 2222.3 J kg^{-1} ^{o}C^{-1} and latent heat of ice is 336 kJ/kg^{-1}.

A. Final temperature of system will be 0^{o}C.

B. Final temperature of the system will be greater than 0^{o}C.

C. The final system will have a mixture of ice and water in the ratio 5 : 1.

D. The final system will have a mixture of ice and water in the ratio 1 : 5.

E. The final system will have water only.

Choose the correct answer from the options given below:

a) A and D only

b) B and D only

c) A and E only

d) A and C only

7. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100 °C, while the other one is at 0 °C. If the two bodies are brought into contact, then, assuming no heat loss, the final common temperature is

a) 50 °C

b) more than 50 °C

c) 0 °C

d) less than 50 °C but greater than 0 °C

8. 50 g of ice is mixed with 100 g of water at 100 °C. The final temperature of mixture is (latent heat of fusion of ice = 80 cal/g)

a) 40 °C

b) 10 °C

c) 20 °C

d) 30 °C

9. Equal masses of two substances of densities ρ_1 and ρ_2 are mixed together. The density of mixture would be

a) $\sqrt{\rho_1\rho_2}$

b) $\frac{\rho_1\rho_2}{\rho_1+\rho_2}$

c) $\frac{2\rho_1\rho_2}{\rho_1+\rho_2}$

d) $\frac{1}{2}(\rho_1+\rho_2)$

10. 500 g of water and 100 g of ice at 0^{o}C are in a calorimeter whose water equivalent is 40 g. 10 g of steam at 100^{o}C is added to it. Then water in the calorimeter is: (Latent heat of ice = 80 cal/g, Latent heat of steam = 5 cal/g)

a) 600 g

b) 590 g

c) 610 g

d) 280 g

11. 5 gm of steam at 100°C is passed into 6 gm of ice at 0°C. If the latent heats of steam and ice in cal per gm ar 540 and 80 respectively, then the mixture contains:

a) 11 gm of wate

b) 6 gm of water

c) 5 gm of water

d) 8 gm of water

12. In an experiment, a sphere of aluminium of mass 0.20 kg is heated upto 150°C. Immediately, it is put into wa of volume 150 cc at 27°C kept in a calorimeter of water equivalent to 0.025 kg. Final temperature of the system is 40°C. The specific heat of aluminium is: (take 4.2 Joule = 1 calorie)

a) 476 J/kg - °C

b) 378 J/kg - °C

c) 315 J/kg - °C

d) 434 J/kg - °C

13. A 10 watt electric heater is used to heat a container filled with 0.2 kg of water. It is found that the temperature of water and the container rises by 3 K in 5 minutes. The container is then emptied, dried and filled with 2 kg of oil. The same heater now raises the temperature of container-oil system by 2 K in 20 minutes. Assuming that there is no heat loss in the process and the specific heat of water as 4200 Jkg^{-1} K^{-1}, the specific heat of oil in the same unit is equal to

a) 1.50×10^3

b) 3.00×10^3

c) 5.10×10^3

d) 2.92×10^3

14. A kettle with 2 litre water at 27°C is heated by operating coil heater of power 1 kW. The heat is lost to the atmosphere at constant rate 160 J/sec, when its lid is open. In how much time will water heated to 77°C with the lid open? (sp. heat of water = 4.2 kJ/kg)

a) 6 min 2 sec

b) 14 min

c) 7 min

d) 8 min 20 sec

15. An unknown metal of mass 192 g heated to a temperature of 100°C was immersed into a brass calorimeter of mass 128 g containing 240 g of water at a temperatur f 8.4°C. Calculate the specific heat of the unknown metal if water temperature stablizes at 21.5°C. (Spec heat of brass is 394 J kg^{-1} K^{-1})

a) 1232 J kg^{-1} K^{-1}

916 J kg^{-1} K^{-1}

c) 654 J kg^{-1} K^{-1}

458 J kg^{-1} K^{-1}

16. Two identical vessels A and B contain water at 30°C and 50°C respectively so that the level of water in both are the same. 10 cc of water is transferred from A to B. The water in B is mixed and 10 cc of it is transferred to A. Then:

a) level of water in A will be less than that in B

b) level of water in both will remain same

c) level of water in A will be more than that in B

d) cannot be said from the given data

17. A calorimeter contains 0.2 kg of water at 30°C. 0.1 kg of water at 60°C is added to it, the mixture is well stirred and the resulting temperature is found to be 35 °C. The thermal capacity of the calorimeter is:

a) 3200 J/K

b) 4200 J/K

c) 6300 J/K

d) 1260 J/K

18. An electrically heated coil is immersed in a calorimeter containing 360 gm of water at 10°C. The coil consumes energy at the rate of 90 watt. The water equivalent of calorimeter and coil is 40 gm. The temperature of the water after 10 minutes is:

a) 4.214°C

b) 42.14°C

c) 30°C

d) 40°C

19. When 100 g of a liquid A at 100°C is added to 50 g of a liquid B at temperature 75°C, the temperature of the mixture becomes 90°C. The temperature of the mixture, if 100 g of liquid A at 100°C is added to 50 g of liquid B at 50°C, will be:

a) 70°C

b) 80°C

c) 85°C d) 60°C

20. 22 gm of CO_2 at 27°C is mixed with 16 gm of O_2 at 37°C. The temperature of the mixture is:

a) 30.5°C b) 27°C

c) 37°C d) 32°C