Book Name: Selina Concise

EXERCISE. 11 A

Solution 1:
The kinetic energy due to random motion of the molecules of a substance is known as its heat energy.

Solution 2:
S.I. unit of heat is joule (symbol J).

Solution 3:
One calorie of heat is the heat energy required to raise the temperature of 1 g of water from $14.5^{o}C$ to $15.5\,^{o}C$.
1 calorie = 4.186 J

Solution 4:
One kilo-calorie of heat is the heat energy required to raise the temperature of 1 kg of water from $14.5^{o}C$ to $15.5^{o}C$.

Solution 5:
The quantity which determines the direction of flow of heat between two bodies kept in contact is called temperature.
S.I. unit kelvin (K).

Solution 6:

Heat	Temperature
The kinetic energy due to random motion of the molecules of a substance is known as its heat energy.	The quantity which determines the direction of flow of heat between two bodies kept in contact is called temperature.
S.I. unit joule (J).	S.I. unit kelvin (K).
It is measured by the principle of calorimetry.	It is measured by a thermometer.

Solution 7:
The measurement of the quantity of heat is called calorimetry.

Solution 8:
The heat capacity of a body is the amount of heat energy required to raise its temperature by $1^{o}C$ or 1K.
S.I. unit is joule per kelvin (JK^{-1}).

Solution 9:
The specific heat capacity of a substance is the amount of heat energy required to raise the temperature of unit mass of that substance through by $1^{o}C$ (or 1K).
S.I. unit is joule per kilogram per kelvin ($Jkg^{-1}K^{-1}$).

Solution 10:
Heat capacity = Mass × specific heat capacity

Solution 11:
Heat capacity of the body is the amount of heat required to raise the temperature of (whole) body by 1 ℃whereas specific heat capacity is the amount of heat required to raise the temperature of unit mass of the body by 1 ℃.
Heat capacity of a substance depends upon the material and mass of the body. Specific heat capacity of a substance does not depend on the mass of the body.
S.I. unit of heat capacity is JK^{-1} and S.I. unit of specific heat capacity is $Jkg^{-1}\ K^{-1}$.

Solution 12:
Water has the highest specific heat capacity.

Solution 13:
Specific heat capacity of water = $4200\ J\ kg^{-1}\ K^{-1}$.

Solution 14:

(i) The heat capacity of a body is $50JK^{-1}$ means to increase the temperature of this body by 1K we have to supply 50 joules of energy.
(ii) The specific heat capacity of copper is $0.4Jg^{-1}K^{-1}$ means to increase the temperature of one gram of copper by 1K we have to supply 0.4 joules of energy.

Solution 15:

The quantity of heat energy absorbed by a body depends on three factors :
(i)Mass of the body - The amount of heat energy required is directly proportional to the mass of the substance.
(ii)Nature of material of the body - The amount of heat energy required depends on the nature on the substance and it is expressed in terms of its specific heat capacity c.
(iii)Rise in temperature of the body - The amount of heat energy required is directly proportional to the rise in temperature.

Solution 16:

The expression for the heat energy Q
Q= mc Δ t (in joule)

Solution 17:

(a) Heat capacity of liquid A is less than that of B.
As the substance with low heat capacity shows greater rise in temperature.
(b)
Let C_P and C_q be the specific heat capacities of blocks P and Q respectively,
We know that,

$$c = \frac{Q}{m \times \Delta t}$$

$$\therefore \left(\frac{C_P}{C_Q}\right) = \left(\frac{\frac{Q}{2m \times \Delta t}}{\frac{Q}{m \times \Delta T}}\right) = \frac{1}{2}$$

Hence, the required ratio is 1 : 2

Solution 18:

In the absence of water, if on a cold winter night the atmospheric temperature falls below 0^oC, the water in the fine capillaries of plant will freeze, so the veins will burst due to the increase in the volume of water on freezing. As a result, plants will die and the crop will be destroyed. In order to save the crop on such cold nights, farmers fill their fields with water because water has high specific heat capacity, so it does not allow the temperature in the surrounding area of plants to fall up to 0^oC.

Solution 19:

The specific heat capacity of water is very high. It is about five times as high as that of sand. Hence the heat energy required for the same rise in temperature by a certain mass of water will be nearly five times than that required by the same mass of sand. Similarly, a certain mass of water will give out nearly five times more heat energy than that given by sand of the same mass for the same fall in temperature. As such, sand gets heated or cooled more rapidly as compared to water under the similar conditions. Thus a large difference in temperature is developed between the land and the sea due to which land and sea breezes are formed. These breezes make the climate near the sea shore moderate.

Solution 20:

The reason is that water does not cool quickly due to its large specific heat capacity, so a hot water bottle provides heat energy for fomentation for a long time.

Solution 21:

By allowing water to flow in pipes around the heated parts of a machine, heat energy from such part is removed. Water in pipes extracts more heat from surrounding without much rise in its temperature because of its large specific heat capacity. So, Water is used as an effective coolant.

Solution 22:

(1) Radiator in car.
(2) To avoid freezing of wine and juice bottles.

Solution 23:

A calorimeter is a cylindrical vessel which is used to measure the amount of heat gained or lost by a body when it is mixed with other body.

It is made up of thin copper sheet because:

(i) Copper is a good conductor of heat, so the vessel soon acquires the temperature of its contents.

(ii)Copper has low specific heat capacity so the heat capacity of calorimeter is low and the amount of heat energy taken by the calorimeter from its contents to acquire the temperature of its contents is negligible.

Solution 24:

By making the base of a cooking pan thick, its thermal capacity becomes large and it imparts sufficient heat energy at a low temperature to the food for its proper cooking. Further it keeps the food warm for a long time, after cooking.

Solution 25:

The principle of method of mixture:

Heat energy lost by the hot body = Heat energy gained by the cold body.

This principle is based on law of conservation of energy.

Solution 26:

A mass m_1 of a substance A of specific heat capacity c_1 at temperature T_1 is mixed with a mass m_2 of other substance B of specific heat capacity c_2 at a lower temperature T_2 and final temperature of the mixture becomes T.

Fall in temperature of substance A = $T_1 – T$

Rise in temperature of substance B = $T – T_2$

Heat energy lost by A = $m_1 \times c_1 \times$ fall in temperature

$= m_1c_1 (T_1 – T)$

Heat energy gained by B = $m_2 \times c_2 \times$ rise in temperature

$= m_2c_2 (T – T_2)$

If no energy lost in the surrounding, then by the principle of mixtures,

Heat energy lost by A = Heat energy gained by B

$m_1c_1(T_1 - T) = m_2c_2(T – T_2)$

After rearranging this equation, we get

$$T = \frac{m_1c_1T_1 + m_2c_2T_2}{m_1c_1 + m_2c_2}$$

Here we have assumed that there is no loss of heat energy.

Solution 27:

We can do a simple experiment as follows:

1) The given solid in the form of a small piece, is first weighed and is then heated by suspending it by a thread in a beaker containing boiling water.
2) While the solid is getting heated, the empty dry calorimeter with the stirrer is weighed. The calorimeter is then filled nearly one third with water and is weighed again. The difference in the two reading gives the mass of water taken.
3) The initial temperature of water in the calorimeter is noted with a thermometer.
4) When the solid has attained the steady temperature, its temperature is recorded by the thermometer kept in boiling water.
5) The solid is then gently dropped into the calorimeter carefully without splashing out the water.
6) The contents of the calorimeter are well stirred and the final highest temperature reached is noted.

Then specific heat capacity of solid can be calculated by the formula:

$$c = \frac{\left[\left(m_2 - m_1\right)c_w + m_1 c_c\right]\left(T - T_1\right)}{m\left(T_2 - T\right)} JKg^{-1}K^{-1}$$

where, Mass of solid = m kg

Mass of calorimeter = m_1 kg

Mass of calorimeter + water = m_2 Kg

Initial temperature of water = T_1 ^oC

Temperature of heated solid = $T_2$$^oC$

Temperature of mixture = T^o C

c is the specific heat capacity of solid

c_c is the specific heat capacity of material of the calorimeter

c_w is the specific heat capacity of water

Solution 28:

In this case we take a solid of known specific heat capacity. Then follow this procedure:

(1)The solid in the form of small piece, is first weighed and is then heated by suspending it by a thread in a beaker containing boiling water.

(2)While the solid is getting heated, the empty dry calorimeter with the stirrer is weighed. The calorimeter is then filled nearly one third with olive oil and is weighed again. The difference in the two reading gives the mass of olive oil taken.

(3)The initial temperature of olive oil in the calorimeter is noted with a thermometer.

(4)When the solid has attained the steady temperature, its temperature is recorded by the thermometer kept in boiling water.

(5)The solid is then gently dropped into the calorimeter carefully without splashing out the

olive oil.
(6)The contents of the calorimeter are well stirred and the final highest temperature reached is noted.
Then specific heat capacity of olive oil (c_L) can be calculated by the formula:

$$c_L = \frac{mc(T_2 - T) - m_1 c_c (T - T_1)}{(m_2 - m_1)(T - T_1)} JKg^{-1}K^{-1}$$

where, mass of solid = m kg.
Mass of calorimeter = m_1 kg.
Mass of calorimeter + olive oil = m_2 Kg
Initial temperature of olive oil = T_1°C
Temperature of heated solid = T_2°C
Temperature of mixture = T°C
c is the specific heat capacity of solid
c_c is the specific heat capacity of material of the calorimeter

Solution 29:
The specific heat capacity c of the solid in terms of the above data is:

$$c = \frac{(xc_1 + yc_2)(T - T_1)}{z(T_2 - T)}$$

Solution 30:
The specific heat capacity of liquid in terms of the above data is:

$$c = \frac{P\ t}{m \triangle T}$$

MUTIPLE CHOICE QUESTIONS:

Solution 1:
JK^{-1}

Solution 2:
$J\ kg^{-1}\ K^{-1}$

Solution 3:
4200 J kg^{-1} K^{-1}

NUMERCIALS:

Solution 1:
The size of 1 degree on the Kelvin scale is the same as the size of 1 degree on the Celsius scale. Thus, the difference (or change) in temperature is the same on both the Celsius and Kelvin scales.
Therefore, the corresponding rise in temperature on the Kelvin scale will be 15K.

Solution 2:
(i) Mass of copper vessel = 150 g
= 0.15 kg
The specific heat capacity of copper = 410 J kg^{-1} K^{-1}.
Heat capacity = Mass × specific heat capacity
= 0.15 kg × 410J$kg^{-1}K^{-1}$
= 61.5JK^{-1}
Change in temperature= $(35 - 25)^oC = 10^oC = 10K$
(ii) Energy required to increase the temperature of vessel
$\Delta Q = mc\Delta T$
$= 0.15 \times 410 \times 10$
$= 615$ J

Solution 3:
(i)We know that heat energy needed to raise the temperature by 15^o is = heat capacity × change in temperature.
Heat energy required = 966 J K^{-1} × 15 K = 14490 J.
(ii)We know that specific heat capacity is = heat capacity/ mass of substance
So specific heat capacity is = 966 / 2 = 483 J kg^{-1} K^{-1}.

Solution 4:
Mass of copper m = 100 g = 0.1 kg
Change of temperature $\Delta t = (70 - 20)^oC$
Specific heat of capacity of copper = 390 J kg^{-1} K^{-1}

Amount of heat required to raise the temperature of 0.1 kg of copper is
$Q = m \times \Delta t \times c$
$= 0.1 \times 50 \times 390$
$= 1950$ J

Solution 5:

Heat energy supplied = 1300 J
Mass of lead = 0.5 kg
Change in temperature = $(40-20)^oC = 20\,^oC$ (or 20 K)
Specific heat capacity of lead

$$c = \frac{\Delta Q}{m\Delta T}$$

$$c = \frac{1300}{0.5 \times 20}$$

$c = 130\ J\ kg^{-1}\ K^{-1}$

Solution 6:

Specific heat capacity of material $c = 960\ J\ kg^{-1}\ K^{-1}$
Change in temperature $\Delta T = (38 - 18)^oC = 20^oC$ (or 20 K)
Power of heater P = 500 W
$\Delta Q = mc\Delta T$
$\Delta Q = 50 \times 960 \times 20$
Time taken by a heater to raise the temperature of material

$$t = \frac{\Delta Q}{P}$$

$$t = \frac{50 \times 960 \times 20}{500}$$

t = 1920 seconds
t = 32 min

Solution 7:

Power of heater P = 600 W
Mass of liquid m = 4.0 kg
Change in temperature of liquid = $(15 - 10)^oC = 5^oC$(or 5 K)
Time taken to raise its temperature = 100s
Heat energy required to heat the liquid

$\Delta Q = mc\Delta T$

And

$\Delta Q = P \times t = 600 \times 100 = 60000J$

$$c = \frac{\Delta Q}{m\Delta T} = \frac{60000}{4 \times 5} = 3000\,Jkg^{-1}K^{-1}$$

Heat capacity = c × m

Heat capacity = $4 \times 3000 JKg^{-1} K^{-1} = 1.2 \times 10^4$ J/K

Solution 8:

Change in temperature= 30 − 5 = 25 K.

$\Delta Q = mc\Delta T$

$\Delta Q = 0.5 \times 4200 \times 25 = 52500J$

$$t = \frac{\Delta Q}{P} = \frac{52500}{30} = 1750s$$

t = 29 min 10 sec

Solution 9:

Mass of certain metal(m_1) = 200 g

Temperature (T_1) = 83^{o}C

Mass of water(m_2) = 300 g

Temperature of water (T_2) = 30^{o}C

Final temperature (T) = 33^{o}C

Specific heat capacity of water c_2 = 4.2 J/g/K

The specific heat capacity of the metal c_1 is given by this formula

$$m_1c_1(T_1 - T) = m_2c_2(T - T_2)$$

$$\frac{(T - T_2)m_2c_2}{m_1(T_1 - T)} = c_1$$

$$c_1 = \frac{(33-30) \times 300 \times 4.2}{200 \times (83-33)}$$

$$c_1 = 0.378JK^{-1}$$

Solution 10:

Mass of water (m_1) = 45 g
Temperature of water (T_1) = 50^oC
Mass of copper (m_2) = 50 g
temperature of copper(T_2) = 18^oC
Final temperature (T) = ?
The specific heat capacity of the copper c_2 = 0.39 J/g/K
The specific heat capacity of water c_1 = 4.2 J/g/K

$$m_1c_1(T_1 - T) = m_2c_2(T - T_2)$$

$$T = \frac{m_1c_1T_1 + m_2c_2T_2}{m_2c_2 + m_1c_1}$$

$$T = \frac{45 \times 4.2 \times 50 + 50 \times 0.39 \times 18}{45 \times 4.2 + 50 \times 0.39} = \frac{9801}{208.5} = 47^\circ c$$

$$T = 47^\circ C$$

Solution 11:

Mass of hot water (m_1) = 200g
Temperature of hot water (T_1) = 80^oC
Mass of cold water (m_2) = 300g
Temperature of cold water (T_2) =10^oC
Final temperature (T) = ?

$$m_1c_1(T_1 - T) = m_2c_2(T - T_2)$$

$c_1 = c_2$

$$T = \frac{m_1T_1 + m_2T_2}{m_2 + m_1}$$

$$T = \frac{200 \times 80 + 300 \times 10}{500}$$

T = 38^oC.

Solution 12:

Mass of hot water (m_1) = 300 g
Temperature (T_1) = 50^oC
Mass of cold water (m_2) = 600 g
Change in temperature of cold water ($T - T_2$) = 15^oC

Final temperature = $T^{o}C$
The specific heat capacity of water is c.

$$m_1c_1(T_1 - T) = m_2c_2(T - T_2)$$

300(50 – T) = 600 (15)
$T = 20^{o}C$.
Final temperature = 20^{o} c
Change in temperature = $15^{o}C$
Initial temperature of cold water = $20^{o}C - 15^{o}C = 5^{o}C$.

Solution 13:

Mass of water = 1000 g.
Change in temperature=$100^{o}C - 25\,^{o}C = 75\,^{o}C$ (or 75K)
Amount of heat energy required to raise temperature = $1000 \times 4.2 \times 75 = 315000$ J.
Time taken to raise the temperature, T = 4 min 12 seconds.

EXERCISE. 11 B

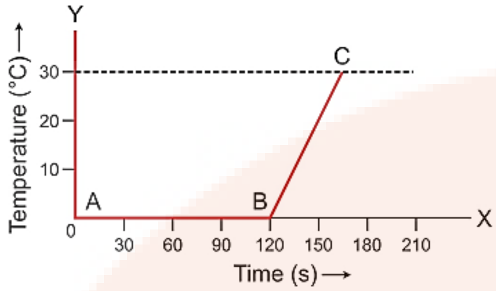
Solution 1:

(a) The process of change from one state to another at a constant temperature is called the change of phase of substance.
(b)There is no change in temperature during the change of phase.
(c)Yes, the substance absorbs or liberates heat during the change of phase.

Solution 2:

Melting: The change from solid to liquid phase on heating at a constant temperature is called melting.
Melting point: The constant temperature at which a solid changes to liquid is called the melting point.

Solution 3:



Experiment to show that there is absorption of heat energy when ice melts:

1) Take a boiling test tube and fill it half with the ice chips. Insert a thermometer gently into the ice taking care that its bulbs does not touch the walls of test tube. Note the temperature of ice. It will be $0^{o}C$.

2) Heat the test tube slowly over the flame and note the temperature after every half minute till the temperature of water formed after melting of ice increases to $30^{o}C$.

Plot a graph between temperature and time. This graph is called heating curve of ice. From the graph, it is clear that the temperature of ice remains constant equal to $0^{o}C$ in the AB part till the whole ice is melted. The heat supplied during this time is being used in melting the ice. After this, the temperature of water formed by melting the ice begins to rise in the part BC. Thus, change of phase occurs in part AB and heat energy is absorbed during this time without any rise in temperature.

Solution 4:

(i) Average kinetic energy of molecules changes.

(ii) Average potential energy of molecules changes.

Solution 5:

(a) Average kinetic energy does not change.

(b) Average potential energy increases.

Explanation: When a substance is heated at constant temperature (i.e. during its phase change state), the heat supplied makes the vibrating molecules gain potential energy to overcome the intermolecular force of attraction and move about freely. This means that the substance changes its form.

However, this heat does not increase the kinetic energy of the molecules, and hence, no rise in temperature takes place during the change in phase of a substance.

This heat supplied to the substance is known as latent heat and is utilized in changing the state of matter without any rise in temperature.

Solution 6:

The melting point of ice decreases by the presence of impurity in it.
Use: In making the freezing mixture by adding salt to ice. This freezing mixture is used in preparation of ice creams.

Solution 7:

The melting point of ice decreases by the increase in pressure. The melting point of ice decrease by 0.0072^{o}C for every one atmosphere rise in pressure.

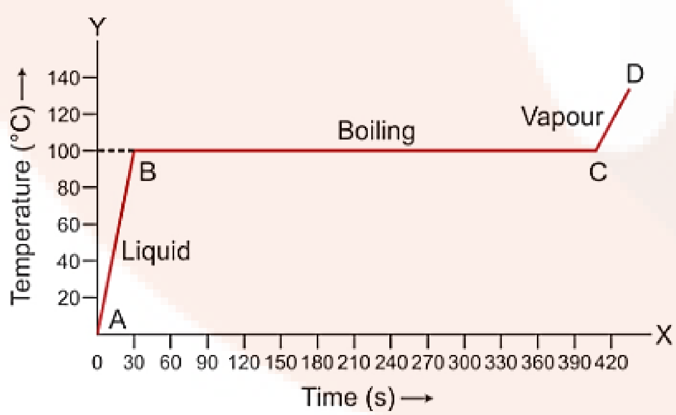
Solution 8:

(i) In part PQ, the wax is in liquid phase.
(ii) In the part QS, temperature remains constant with time, and hence, this part of the curve represents freezing.
(iii) In part QS, the wax will be in the liquid as well as solid phase.
(iv) In part ST, the wax is in solid phase.

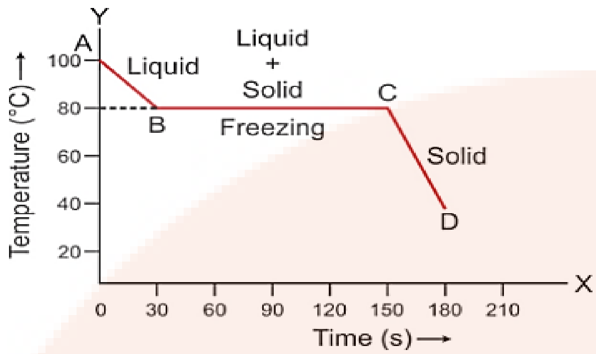
Solution 9:

(a) AB part shows rise in temperature of solid from 0 to T_1^{o}C, BC part shows melting at temperature T_1^{o}C, CD part shows rise in temperature of liquid from T_1^{o}C to T_3^{o}C , DE part shows the boiling at temperature T_3^{o}C.
(b) T_1^{o}C.
(c) T_3^{o}C.

Solution 10:



Solution 11:



Solution 12:

Boiling: The change from liquid to gaseous phase on heating at a constant temperature is called boiling.
Boiling point: The particular temperature at which vaporization occurs is called the boiling point of liquid.

Solution 13:

Volume of water wills increases when it boils at 100°C.

Solution 14:

The boiling point of water increases on adding salt.

Solution 15:

The boiling point of a liquid increases on increasing the pressure.

Solution 16:

In a pressure cooker, the water boils at about 120°C to 125°C.

Solution 17:

This is because at high altitudes atmospheric pressure is low; therefore, boiling point of water decreases and so it does not provide the required heat energy for cooking.

Solution 18:

(a) When ice melts, its volume decreases.
(b) Decrease in pressure over ice increases its melting point.
(c) Increase in pressure increases the boiling point of water.
(d)A pressure cooker is based on the principle that boiling point of water increases with the increase in pressure.
(e) The boiling point of water is defined as the constant temperature at which water changes to steam.

Solution 19:

Latent heat: The heat energy exchanged in change of phase is not externally manifested by any rise or fall in temperature, it is considered to be hidden in the substance and is called the latent heat.

Solution 20:

The quantity of heat required to convert unit mass of ice into liquid water at 0° C (melting point) is called the specific latent heat of fusion of ice.
Its S.I. unit is Jkg^{-1}.

Solution 21:

Specific latent heat of ice: 336000 J kg^{-1}.

Solution 22:

It means 1 g of ice at 0^{o}C absorbs 360 J of heat energy to convert into water at 0^{o}C.

Solution 23:

Latent heat is absorbed by ice.

Solution 24:

1 g of water at 0^oC has more heat than 1 g of ice at 0^oC. This is because ice at 0^oC absorbs 360 J of heat energy to convert into water at 0^oC.

Solution 25:

(a) 1 g ice at 0^oC requires more heat because ice would require additional heat energy equal to latent heat of melting.
(b) 1 g ice at 0^oC first absorbs 336 J heat to convert into 1 g water at 0^oC.

Solution 26:

This is because 1 g of ice at 0^oC takes 336 J of heat energy from the mouth to melt at 0^oC. Thus, mouth loses an additional 336 J of heat energy for 1 g of ice at 0^oC than for 1g of water at 0^oC. Therefore, cooling produced by 1 g of ice at 0^oC is more than for 1g of water at 0^oC.

Solution 27:

This is because 1 g of ice at 0^oC takes 336 J of heat energy from the bottle to melt into water at 0^oC. Thus, bottle loses an additional 336 J of heat energy for 1 g of ice at 0^oC than for 1 g iced water at 0^oC. Therefore, bottled soft drinks get cooled, more quickly by the ice cubes than by iced water.

Solution 28:

The reason is that after the hail storm, the ice absorbs the heat energy required for melting from the surrounding, so the temperature of the surrounding falls further down and we feel colder.

Solution 29:

The reason is that the heat energy required for melting the frozen lake is absorbed from the surrounding atmosphere. As a result, the temperature of the surrounding falls and it became very cold.

Solution 30:

(i) The reason is that the specific latent heat of fusion of ice is sufficiently high, so when the water of lake freezes, a large quantity of heat has to be released and hence the surrounding

temperature becomes pleasantly warm.
(ii) Heat supplied to a substance during its change of state, does not cause any rise in its temperature because this is latent heat of phase change which is required to change the phase only.

MULTIPLE CHOICE TYPE:

Solution 1:

$J\ kg^{-1}$

Solution 2:

$80\ cal\ g^{-1}$

NUMERICALS:

Solution 1:

Mass of ice = 10g = 0.01kg

Amount of heat energy absorbed, Q = 5460J

Specific latent heat of fusion of ice = ?

Specific heat capacity of water = $4200 Jkg^{-1}K^{-1}$

Amount of heat energy required by 10g (0.01kg) of water at 0^oC to raise its temperature by $50^oC = 0.01 \times 4200 \times 50 = 2100J$.

Let Specific latent heat of fusion of ice=L Jg^{-1}.

Then,

$Q = mL + mc\Delta T$

$5460\ J = 10 \times L + 2100J$

$L = 336 Jg^{-1}$.

Solution 2:

Mass of water m = 5.0 g

specific heat capacity of water c = $4.2\ J\ g^{-1}\ K^{-1}$

specific latent heat of fusion of iceL = $336\ J\ g^{-1}$

Amount of heat energy released when 5.0 g of water at 20^oC changes into water at $0^oC = 5 \times 4.2 \times 20 = 420$ J.

Amount of heat energy released when 5.0g of water at 0^oC changes into ice at $0^oC = 5 \times 336J$

= 1680J.
Total amount of heat released = 1680 J + 420 J = 2100 J.

Solution 3:

Mass of metal = 150 g
Specific latent heat of metal

$$L = \frac{Q}{m} = \frac{75000}{150} = 500\,Jg^{-1}$$

Specific heat capacity of metal is 200 J kg^{-1} K^{-1}.
Change in temperature= 800 − (−50) = 850°C (or 850 K).

$$\Delta Q = mc\Delta T = 0.15 \times 200 \times 850 = 25500J$$

Solution 4:

Amount of heat released when 100g of water cools from 20° to 0°C = 100 × 20 × 4.2 = 8400J.
Amount of heat released when 100g of water converts into ice at 0°C = 100 × 336 = 33600J.
Amount of heat released when 100g of ice cools from 0°C to -10°C = 100 × 10 × 2.1 = 2100J.
Total amount of heat = 8400 + 33600 + 2100 = 44100J.
Time taken = 73.5min = 4410s.
Average rate of heat extraction (power)

$$P = \frac{E}{t} = \frac{44100}{4410} = 10W$$

Solution 5:

Mass of ice m_1 = 17 g
Mass of water m_2 = 40 g.
Change in temperature = 34 – 0 = 34K
Specific heat capacity of water is 4.2$Jg^{-1}K^{-1}$.
Assuming there is no loss of heat, heat energy gained by ice (latent heat of ice), Q= heat energy released by water
Q = 40 × 34 × 4.2 = 5712 J.
Specific latent heat of ice =

$$L = \frac{Q}{m} = \frac{5712}{17} = 336Jg^{-1}$$

Solution 6:

Let whole of the ice melts and let the final temperature of the mixture be T^oC.

Amount of heat energy gained by 10g of ice at -10^oC to raise its temperature to $0^oC = 10 \times 10 \times 2.1 = 210J$

Amount of heat energy gained by 10g of ice at 0^oC to convert into water at $0^oC = 10 \times 336 = 3360$ J

Amount of heat energy gained by 10g of water (obtained from ice) at 0^oC to raise its temperature to $T^oC = 10 \times 4.2 \times (T - 0) = 42T$

Amount of heat energy released by 10g of water at 10^oC to lower its temperature to $T^oC = 10 \times 4.2 \times (10 - T) = 420 - 42T$

Heat energy gained = Heat energy lost

$210 + 3360 + 42T = 420 - 42T$

$T = -37.5^oC$

This cannot be true because water cannot exist at this temperature.

So whole of the ice does not melt. Let m gm of ice melts. The final temperature of the mixture becomes 0^oC.

So, amount of heat energy gained by 10g of ice at -10^oC to raise its temperature to $0^oC = 10 \times 10 \times 2.1 = 210J$

Amount of heat energy gained by m gm of ice at 0^oC to convert into water at $0^oC = m \times 336 = 336m$ J

Amount of heat energy released by 10g of water at 10^oC to lower its temperature to $0^oC = 10 \times 4.2 \times 10 - 0) = 420$

Heat energy gained = Heat energy lost

$210 + 336m = 420$

$m = 0.625$ gm

Solution 7:

Let final temperature of water when all the ice has melted = T^oC.

Amount of heat lost when 200g of water at 50^oC cools to T^oC =

$200 \times 4.2 \times (50 - T) = 42000 - 840T$

Amount of heat gained when 40g of ice at 0^oC converts into water at 0^oC.= $40 \times 336J = 13440$ J

Amount of heat gained when temperature of 40g of water at 0^oC rises to $T^oC = 40 \times 4.2 \times (T-0) = 168T$

We know that

Amount of heat gained = amount of heat energy lost.

$13440 + 168T = 42000 - 840T$

$168T + 840T = 42000 - 13440$
$1008T = 28560$
$T = 28560/1008 = 28.33^{o}C.$

Solution 8:

Mass of copper vessel $m_1 = 50$ g.
Mass of water contained in copper vessel $m_2 = 250$ g.
Mass of ice required to bring down the temperature of vessel = m
Final temperature = 5^{o} C.
Amount of heat gained when 'm' g of ice at 0^{o} C converts into water at 0^{o} C = m × 336 J
Amount of heat gained when temperature of 'm' g of water at 0^{o} C rises to 5^{o} C = m × 4.2 × 5
Total amount of heat gained = m × 336 + m × 4.2 × 5
Amount of heat lost when 250 g of water at 30^{o} C cools to 5^{o} C = 250 × 4.2 × 25 = 26250 J
Amount of heat lost when 50 g of vessel at 30^{o} C cools to 5^{o} C = 50 × 0.4 × 25 = 500 J
Total amount of heat lost = 26250 + 500 = 26750 J
We know that amount of heat gained = amount of heat lost
$m \times 336 + m \times 4.2 \times 5 = 26750$
$357\ m = 26750$
$m = 26750/357 = 74.93$ g
Hence, mass of ice required is 74.93 g.

Solution 9:

Since the whole block does not melt and only 2 kg of it melts, so the final temperature would be $0\ ^{o}$C.
Amount of heat energy gained by 2 kg of ice at 0^{o}C to convert into water at 0^{o}C = 2 × 336000 = 672000 J
Let amount of water poured = m kg.
Initial temperature of water = 100^{o}C.
Final temperature of water = 0^{o}C.
Amount of heat energy lost by m kg of water at 100^{o}C to reach temperature 0^{o}C = m × 4200 × 100 = 420000m J
We know that heat energy gained =heat energy lost.
$672000J = m \times 420000J$
$m = 672000/420000 = 1.6kg$

Solution 10:

Amount of heat energy gained by 100 g of ice at -10^o C to raise its temperature to 0^o C =
$100 \times 2.1 \times 10 = 2100$ J
Amount of heat energy gained by 100 g of ice at 0^o C to convert into water at 0^o C =
$100 \times 336 = 33600$ J
Amount of heat energy gained when temperature of 100 g of water at 0^o C rises to 100^o C =
$100 \times 4.2 \times 100 = 42000$ J
Total amount of heat energy gained is = $2100 + 33600 + 42000 = 77700$ J = 7.77×10^4 J

Solution 11:

Amount of heat energy gained by 1kg of ice at −10^{o}C to raise its temperature to 0^{o}C = $1 \times 2100 \times 10 = 21000$ J
Amount of heat energy gained by 1kg of ice at 0^{o}C to convert into water at 0^{o}C = L
Amount of heat energy gained when temperature of 1kg of water at 0^{o}C rises to 100^{o}C = $1 \times 4200 \times 100 = 420000$ J
Total amount of heat energy gained = 21000 + 420000 + L = 441000 + L.
Given that total amount of heat gained is = 777000J.
So,
441000 + L = 777000.
L = 777000 − 441000.
L = 336000JKg^{-1}

EXCERCICE. 11 C

Solution 1:

The earth receives heat radiations from sun which reach us after passing through its atmosphere. The earth's atmosphere is transparent for the visible and thermal radiations of short wavelengths coming from the sun. The earth's surface and objects on it thus become warm in the day time. After the sunset, the earth's surface and the objects on it radiate the infrared radiations of long wavelengths. A part of these radiations are reflected back by the clouds and a part of it is absorbed by the green house gases like carbon dioxide, methane, water vapours and chlorofluorocarbons. Thus the clouds and green house gases prevents a large fraction of radiations given out by the earth's surface, from escaping into the space. This phenomenon is called greenhouse effect.

Solution 2:
Carbon dioxide, methane, water vapours and chlorofluorocarbons.

Solution 3:
(a) Short wavelength radiations
(b) Long wavelength radiations

Solution 4:
Coal, petroleum, natural gas.

Solution 5:
From sun, we receive 1366W m^{-2} energy at the top of our earth's atmosphere, out of which only 235Wm^{-2} energy reaches near the earth's surface. The earth and ocean surface absorbs 168 W m^{-2} energy and only 67 W m^{-2} energy remains in the lower atmosphere. With this much energy received on earth surface, its actual surface temperature would have been around -18^{0}C which is quite uncomfortable for human living. Fortunately the greenhouse gases present in the earth's atmosphere contribute in trapping the heat energy within the atmosphere and they produce an average warming effect of about 33^{0}C to keep the effective temperature around 15^{0}C. So, greenhouse effect helps in keeping the temperature of earth's surface suitable for living of human beings.

Solution 6:
Three reasons for increase of greenhouse gases:
1. The burning of fuels, deforestation and industrial production
2. Increase of population.
3. Imbalance of carbon dioxide cycle

Solution 7:
The effect of enhancement of greenhouse effect are:
1. The variable change in the climate in different parts of the world has created difficulty and

forced the people and animals to migrate from one place to another place.
2. It has affected the blooming season of the different plants.
3. The climate changes have shown the immediate effect on simple organism and plants.
4. It has affected the world's ecology.
5. It has increased the heat stroke deaths.

Solution 8:

Global warming means the increase in the average effective temperature of earth's surface due to an increase in the amount of greenhouse gases in its atmosphere.

Solution 9:

The effect of enhancement of greenhouse effect are:
1. The variable change in the climate in different parts of the world has created difficulty and forced the people and animals to migrate from one place to another place.
2. It has affected the blooming season of the different plants.
3. The climate changes have shown the immediate effect on simple organism and plants.
4. It has affected the world's ecology.
5. It has increased the heat stroke deaths.

Solution 10:

Due to rise in sea level the building and roads in the coastal areas will get flooded and they could suffer damage from hurricanes and tropical storms.

Solution 11:

Due to global warming, many new diseases have emerged because bacteria can survive better in increased temperature and they can multiply faster. It is extending the distribution of mosquitoes due to increase in humanity levels and their frequent growth in warmer atmosphere. This has resulted in increase of many new diseases. The deaths due to heat stroke have certainly increased.

Solution 12:

At the present rate of increase of green house effect, it is expected that nearly 30% of animal species will extinct by the year 2050 and up to 70% by the end of the year 2100. This will disturb ecosystem. The animals from the equatorial region will shift to higher latitude in search of ice and cold region. The absorption of carbon dioxide by the ocean will cause acidification due to which marine species will migrate.

Solution 13:

At the present rate of increase of green house effect, it is expected that nearly 30% of the plant species will extinct by the year 2050 and up to 70% by the end of the year 2100. In the near future, warming of nearly 3^oC will result in poor yield in farms in low latitude regions. This will increase the rise of malnutrition.

Solution 14:

At the present rate of increase in green house effect, is estimated that nearly 30% of the plant and animal species will extinct by the year 2050 and upto 70 % by the end of year 2100. This will disrupt ecosystem. The animals from the equatorial region will shift to higher latitude in search of cold regions. The absorption of carbon dioxide by ocean will cause acidification due to which marine species will migrate.

Solution 15:

Avoid Deforstation

By Conservation of water.

Usage of fossil fuel should be reduced.

Solution 16:

The tax calculated on the basis of: carbon emission from industry, number of employee hour and turnover of the factory is called carbon tax.

This tax shall be paid by industries. This will encourage the industries to use the energy efficient techniques.

MUTIPLE CHOICE

Solution 1:

$-18° C$

Solution 2:

The increase in sea levels.

Explanation: Due to global warming, the average temperature of the Earth has increased and has lead to the melting of ice around both the poles. This melting of ice has lead to an increase in the level of water in sea.