

## SHORT ANSWER

## Question 1(A)

You are heating up left overs in the microwave which emits EMR with wavelength around 33mm. How long should you expect to have to heat up your left overs given its heat capacity is 1.9 kJ/C and the microwave emits photons at a constant rate of 1.00 mole per minute.

$$E = h\nu \quad h = -6.63 \times 10^{-34} \text{ J}^\circ\text{sec}$$

## Answer 1(A)

Given :  $\lambda = 33 \text{ mm}$  or  $33 \times 10^{-3} \text{ m}$  per radiation

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$C = 3 \times 10^8 \text{ ms}^{-1}$$

**Step 1:** Calculate energy using PLANCK EQUATION:

$$E = \frac{hc}{\lambda}$$

$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{33 \times 10^{-3}}$$

$$E = 6.02 \times 10^{-24} \text{ J per radiation}$$

**Step 2:** Calculate energy per mole

$$E = 6.02 \times 10^{-24} \times 6.02 \times 10^{23}$$

$$E = 3.62 \text{ J mol}^{-1}$$

Or  $E = 3.62 \times 10^{-3} \text{ KJ mol}^{-1}$

**Step 3:** Heat required to heat up left over in over is 1.9 KJ/C (Given in question)

$$E = 1.9 \text{ KJ}$$

**Step 4 :** Moles of radiation required to generate above energy

$$\text{moles of radiation required} = \frac{1.9}{3.62 \times 10^{-3}} = 523.6$$

**Step 5 :** Microwave emits photons at a constant rate of 1.0 mole per minute.

$\therefore$  Time required for emission of 523.6 moles of radiation would be

$$= \frac{523.6 \text{ (mole)}}{1 \left( \frac{\text{mol}}{\text{min}} \right)}$$

$$= 523.6 \text{ mn} \quad \text{or} \quad \mathbf{8.72 \text{ hr.}}$$

## Question 1(B)

How might the microwave be producing the microwaves ?

## Answer 1(B)

Microwave are produced because these are radiation which are produced when electrons in excited atom, returns to ground levels, emits energy in form of radiation.

## Question 1(C)

Is it possible for more than one element to emit microwaves? Explain how this is consistent with the idea that electron energy levels are quantized.

## Answer 1(C)

Yes, it is possible for one element to emit microwaves because the energy level in atoms is quantized and when electrons jump from higher energy level to lower energy level. This difference in energy level is emitted as radiation i.e. microwave radiation.