PRISM WORLD

Std.: 8 (English) General Science

Chapter: 14

Q.1 Fill in the blank and rewrite the completed statements 4

1 A thermometer is used to measure .....

Ans A thermometer is used to measure **temperature**.

2 The apparatus used to measure heat is called a ..... .

Ans The apparatus used to measure heat is called a **calorimeter**.

3 Temperature is the measure of the ..... kinetic energy of the atoms in a substance.

Ans Temperature is the measure of the **average** kinetic energy of the atoms in a substance.

4 The heat contained in a substance is the measure of the ..... kinetic energy of atoms in the substance.

Ans The heat contained in a substance is the measure of the **total** kinetic energy of atoms in the substance.

Q.2 Match the pair 1

1 Whom should I pair with ?

Column - A	Column - B
i. Room temperature	a. 0˚C
ii. Freezing point of water	b. 98.6 ˚F
	c. 296 K

Ans

i. Room temperature	296 K
ii. Freezing point of water	0˚C

Q.3 State True or False 6

1 Heat flows from an object at higher temperature to an object at lower temperature.

Ans **True**

2 The average kinetic energy of atoms in a hot object is less than the average kinetic energy of atoms in a cold object.

Ans **False** - The average kinetic energy of atoms in a hot object is more than the average kinetic energy of atoms in a cold object.

3 The temperature of a substance is measured in Joules -

Ans **False -** The Temperature of a substance is measured in ˚C or Kelvin or ˚F, while the heat of the substance is measured in joules.

4 Objects contract on heating.

Ans **False -** Objects expand on heating.

5 Joule is the unit of heat.

Ans **True**

6 Atoms of a solid are free.

Ans **False** - Atoms of a solid are bound tightly to each other.

Q.4 **Answer in one sentence** **1**

1 A bridge is made from 20 m long iron rods. At temperature 18 ^{0}C, the distance between two rods is 0.4 cm. Up to what temperature will the bridge be in good shape?

Ans 35.4 Celsius

Q.5 **Solve Numerical problems:** **8**

1 At 15 °C the height of Eifel tower is 324 m. If it is made of iron, what will be the increase in length in cm, at 30 °C?

Ans Given : Initial height of Eiffel tower (l_1) = 324 m, initial temperature (T_1) = 15 °C, final temperature (T_2) = 30 °C, Coefficient of linear expansion for iron (λiron) = 11.5×10^{-6} (1/°C)

To find : Increase in the height ($l_2 - l_1$)

Formula : $l_2 = l_1 (1 + \lambda \Delta T)$

Calculation : From formula,

$l_2 = l_1 + \lambda\, l_1\, \Delta T$

$\therefore \quad l_2 = l_1 + \lambda\, l_1\, \Delta T$

$11.5 \times 10^{-6} \times 324 \times (30 - 15)$

$= 0.056$m

= 5.6 cm

Increase in the height of Eiffel tower will be **5.6 cm.**

2 When a substance having mass 3 kg receives 600 cal of heat, its temperature increases by 10 °C. What is the specific heat of the substance?

Ans Given : Mass of the substance (m) = 3 kg = 3×10^3 g, amount of heat given (Q) = 600 cal, inital temperature (T_1) = 10 °C, final temperature (T_2) = 70 °C

To find : Specific heat of substance (c)

Formula : $Q = m \times c \times \Delta T$

Calculation : From formula,

$600 \times 3 \times 10^3 \times c \times (70 - 10)$

$= 3 \times 10^3 \times c \times 60$

$\therefore \quad c = \frac{600}{60 \times 3 \times 10^3} = \frac{10}{3} \times 10^{-3}$

= 0.0033 cal/g °C

The specific heat of the substance is **0.0033 cal/g °C**

3 What must be the temperature in Fahrenheit so that it will be twice its value in Celsius?

Ans Given: F = 2C

$\frac{F - 32}{9} = \frac{C}{5}$

$\therefore \quad \frac{2C - 32}{9} = \frac{C}{5}$

$\therefore \quad (2C - 32) \times 5 = C \times 9$

$\therefore \quad 10C - 160 = 9C$

$\therefore \quad C = 160°$

$\therefore \quad F = 160 \times 2$

$= 320°$

4 Two substances A and B have specific heats c and 2 c respectively. If A and B are given Q and 4Q amounts of

heat respectively, the change in their temperatures is the same. If the mass of A is m, what is the mass of B?

Ans Given : Specific heat of substance A (c_A) = c,
specific heat of substance B (c_B) = 2c,
amount of heat given to A (Q_A) = Q,
amount of heat given to B (Q_B) = 4Q,
$\Delta T_A = \Delta T_B$, mass of substance A (m_A) = m

To find : Mass of substance B (m_B)

Formula : $Q = m \times c \times \Delta T$

Calculation : From formula, for substance A,

$$Q_A = m_A \times c_A \times \Delta T_A \quad \text{... (i)}$$

For substance B,

$$Q_B = m_B \times c_B \times \Delta T_B \quad \text{... (ii)}$$

Dividing equation (ii) by equation (i), we get,

$$\frac{Q_B}{Q_A} = \frac{m_B}{m_A} \times \frac{c_B}{c_A} \times \frac{\Delta T_B}{\Delta T_A}$$

Substituting given data,

$$\frac{4Q}{Q} = \frac{m_B}{m} \times \frac{2c}{c}$$

$$\therefore \quad \frac{m_B}{m} = \frac{4}{2} = 2$$

$$\therefore \quad m_B = \mathbf{2m}$$

The mass of substance B is **2m.**

Q.6 **Distinguish between** **2**

1 Heat and temperature

Ans

	Heat		Temperature
i.	The heat contained in a substance is the total kinetic energy of the atoms in the substance.	i.	The temperature is measure of the average kinetic energy of the atoms in the substance.
ii.	Heat content of any substance depends on the number of atoms present in it.	ii.	Temperature of a substance does not depend on the number of atoms present in it.
iii.	It is measured using calorimeter.	iii.	It is measured using thermometer.
iv.	Heat is measured in joules (J) in SI system while, in calories (cal) in CGS system.	iv.	The units of temperature are Celsius (°C), Fahrenheit (°F) and Kelvin (K).

Q.7 **Activity based question (3 mks)** **6**

1 Nishigandha kept a vessel containing all the ingredients for making tea in a solar cooker. Shivani kept a similar vessel on a stove. Whose tea will be ready first and why?

Ans i. Solar cooker uses heat energy generated in the Sun.
ii. The Sun being far away from the earth, very small amount of heat reaches the earth, making the process of heating slow and time-consuming.
iii. Whereas, the stove converts the chemical energy stored in fuels into heat energy.
iv. This energy generated is transferred to vessel in large amounts. Hence, the tea made by Shivani using a stove will be ready first.

2 Explain why rails have gaps at specific distances.

Ans i. During summer, due to change in temperature, the length of the rails increases.
ii. If the rails are made without the gaps in between, then after expansion, the rails may get distorted in summer, leading to rail accidents.
iii. Hence, to accommodate this change in length of the rails, they have gaps at specific distances.

Q.8 **Answer the following** **12**

1 Describe a clinical thermometer. How does it differ from the thermometer used in laboratory?

Ans i. A clinical thermometer consists of a narrow glass tube having a bulb at one end.

ii. The part of the tube along with the bulb is filled with mercury or alcohol. As mercury is harmful to health, alcohol is preferred.

iii. The rest of the tube is evacuated and the other end of the tube is closed.

iv. The bulb is kept in contact with the body of a person whose body temperature is to be measured. Thus, the temperature of the bulb becomes same as that of the body of the person.

v. If the body temperature is high, because of the increased temperature, the alcohol inside the tube expands and it rises in the tube. The body temperature can be obtained from the level of the alcohol inside the tube.

vi. As the clinical thermometer is mainly used to measure body temperature, the range of this thermometer is marked from 35˚C to 42˚C.

vii. The thermometer which is used in laboratories is constructed in similar manner except that the thermometers in laboratory can measure temperatures ranging from 40˚C to 110˚C or larger in some cases.

2 Explain with the help of formulae the expansion coefficients of liquid and gas.

Ans i. Expansion of liquids

ii. A liquid does not have a definite shape but it has a definite volume.

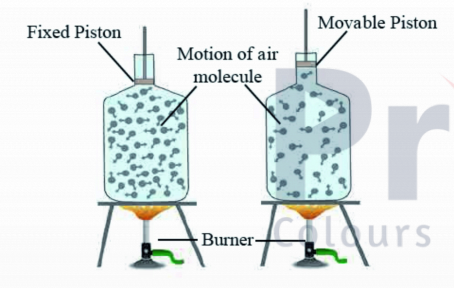
iii. So we can define a volumetric expansion coefficient for a liquid as follows.

iv. V2 = V1 (1 + b DT) Here, DT is the change in temperature and V1 and V2 are the initial and final volumes of the liquid. b is the volumetric expansion coefficient of the liquid

v. Expansion of gases

vi. A gas does not even have a fixed volume.

vii. Gas expands on heating but if the gas is kept in a closed box, its volume cannot increase but its pressure increases. This is shown in figure given below.



3 Explain with the help of formulae the expansion coefficients of liquid and gas.

Ans **Coefficient of expansion for liquids**:

i. Liquids do not have definite shape or size, but they have definite volume. Hence, liquids possess volumetric expansion coefficient.

ii. Let liquid of initial volume V_1 expands to a volume V_2 when heated. If ΔT is the change in temperature, then, $V_2 = V_1 (1 + \beta \Delta T)$

Here, is volumetric expansion coefficient of the liquid.

Coefficient of expansion for gases:

i. Gases do not possess definite shape, size or volume. They occupy the volume of the container.

ii. Gases expand on heating when kept in a open container. If the gas is kept in a closed container and heated, then the pressure on the gas increases while, the volume remains unchanged.

iii. Thus, the expansion of a gas is measured under constant pressure and the expansion coefficient is termed as constant pressure expansion coefficient.

iv. If a gas is heated in a beaker with a movable piston attached to the beaker, then pressure remains constant while volume increases. In such a case, volumetric expansion is given as,

$V_2 = V_1 (1 + \beta \Delta T)$

Here, V_2 = Final volume of the gas,

V_1 = Initial volume of the gas,

β = Constant pressure expansion coefficient,

ΔT = Change in the temperature.

4 Explain the construction of a calorimeter. Draw the necessary figure.

Ans A calorimeter is a device used to measure heat content of an object.

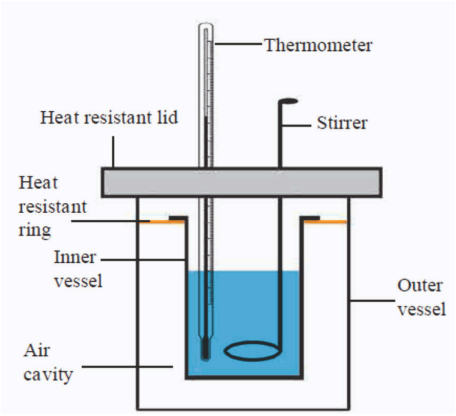
Construction:

i. A calorimeter consists of two vessels similar to that of thermos flask. The inner vessel is made of copper.

ii. The space between inner vessel and the outer vessel is filled with insulator like air. Both the vessels are connected to each other by a heat resistant ring so that, no heat is transferred between the inner vessel and the surroundings. Thus, the inner vessels is thermally isolated from the surroundings.

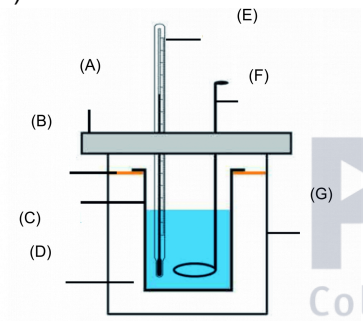
iii. Both the vessels have a single heat resistant lid fitted on top. There are two holes made on the lid from which a thermometer and a stirrer are inserted in the inner vessel.

iv. Thermometer is used to record the temperature of the liquid and stirrer is used for stirring the liquid.



Q.9 **Answer the following in detail** **5**

1 1) Label the calorimeter



2) Enlist the part of calorimeter and explain.

Ans i. A calorimeter similar to a thermos flask, a calorimeter has two vessels, an inner and an outer one.

ii. This way, no heat can be transferred from the inner to the outer vessel or from the outer to the inner vessel.

iii. Thus, the inner vessel is thermally isolated from the surroundings.

iv. The inner vessel is made of copper.

v. A thermometer for measuring the temperature and a stirrer for stirring the liquid in the calorimeter are fitted in it.

vi.