**SAFAL EDUCATION ACADEMY**
**STANDARD – X**
**PHYSICS**
**[Force, Work-Energy-Power, Current Electricity, Household Electricity, Calorimetry]**

TIME : 1.0 Hr MARKS : 20
NAME : ______________________ Marks Obtained : ____

**Q – 1 Solve the following [Force] [3]**

1. A uniform metre scale can be balanced at the 70.0 cm mark when a mass of 0.05 kg is hung from the 94.0 cm mark. (i) Draw a diagram of the arrangement. (ii) Find the mass of the metre scale.

**Q – 2 Solve the following [Work-Energy-Power] [5]**

1. A ball of mass 0-20 kg is thrown vertically upward with an initial velocity of 20 m/s. Calculate the maximum potential energy it gains as it goes up.
2. A coolie carries a load of 30 kgf through a distance of 500 m in 5 minutes while another coolie B carries the same load through the same distance in 10minutes. Compare the (i) work done, and (ii)power developed. [Take: g=10 ms)

**Q – 3 Solve the following [Current Electricity] [5]**

1. The resistance of two resistors joined in series is 8 ohms and in parallel is 1.5 ohm. Find the value of the two resistances.
2. When a resistance of 3 ohm is connected a cross a cell, the current flowing is 0.5 A. On changing the resistance to 7 ohm, the current becomes 0.25 A. Calculate the e.m.f. and the internal resistance of the cell.

**Q – 4 Solve the following [House hold Electricity] [4]**

1. A house is provided with 15 bulbs of 40 W, 5 bulbs of 100 W, 5 fans of 80 W and one heater of 1.0 kW. Each day bulbs are used for 4 h, fans for 10 h and heater for 2 h. The voltage of mains is 220 V. Calculate: (i) maximum power of the circuit in the house, (ii) maximum current capacity of the main fuse in the house, (iii) the electrical energy consumed in a week, (iv)cost of electricity consumed at 1.25 per kWh.

**Q – 5 Solve the following [Calorimetry] [3]**

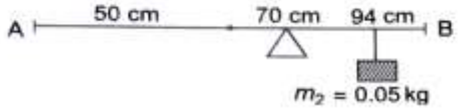
1. 200g of hot water at 80°C is added to 300g of cold water at 10°C. Calculate the final temperature of the mixture of water. Consider the heat taken by the container to be negligible. (Specific heat capacity of water is 4200 Jkgl°c-]

## ANSWERS

**Q – 1 Solve the following [Force] [3]**

1. A uniform metre scale can be balanced at the 70.0 cm mark when a mass of 0.05 kg is hung from the 94.0 cm mark. (i) Draw a diagram of the arrangement. (ii) Find the mass of the metre scale.

**Ans.** (i) Diagram of the given arrangement is shown below:




(ii) As the given meter scale is a uniform scale, so its centre of gravity lies at 50 cm. Let mass of metre scale be $m_1$ kg and its weight ($m_1$ kgf) will act at 50 cm mark.

By principle of moments,

$$m_1 x_1 = m_2 x_2$$

$$m_1 \times (70 - 50) = 0{\cdot}05 \times (94 - 70)$$

$$m_1 = \frac{0.05 \times 24}{20}$$

$$= 0{\cdot}06 \text{ kg.}$$

$$= 60 \text{ g.}$$

**Q – 2 Solve the following [Work-Energy-Power] [5]**

1. A ball of mass 0-20 kg is thrown vertically upward with an initial velocity of 20 m/s. Calculate the maximum potential energy it gains as it goes up.

**Ans.** Maximum kinetic energy

$$= \frac{1}{2} mv^2 = \frac{1}{2} \times 0{\cdot}20 \times 20 \times 20 = 40 \text{ J}$$

According to the principle of conservation of energy,

Maximum potential energy

= Maximum kinetic energy = 40 J.

2. A coolie carries a load of 30 kgf through a distance of 500 m in 5 minutes while another coolie B carries the same load through the same distance in 10minutes. Compare the (i) work done, and (ii)power developed. [Take: g=10 ms)

**Ans.** Given: F = 30 kgf = 30 × $g$ N = 30 × 10 N = 300 N,

$s$ = 500 m.

For coolie A, work done ($W_1$)

$= F \times s = 300 \times 500 = 150{,}000$ J

Time ($t_1$) = 5 minutes = 5 × 60 s = 300 s

∴ Power developed ($P_1$)

$$= \frac{W_1}{t_1} = \frac{150{,}000}{300} = 500 \text{ Js}^{-1}$$

For coolie B, work done ($W_2$)

$= F \times s = 300 \times 500 = 150{,}000$ J

Time ($t_2$) = 10 minutes = 10 × 60 s = 600 s

∴ Power developed ($P_2$)

$$= \frac{W_2}{t_2} = \frac{150,000}{600} = 250\ Js^{-1}$$

(i) $$\frac{W_1}{W_2} = \frac{150,000}{1,50,000} = \frac{1}{1}.$$

(ii) $$\frac{P_1}{P_2} = \frac{500}{250} = \frac{2}{1}.$$

**Q – 3 Solve the following [Current Electricity] [5]**

1. The resistance of two resistors joined in series is 8 ohms and in parallel is 1.5 ohm. Find the value of the two resistances.

**Ans.** In series, $R_1 + R_2 = 8\ \Omega$

In parallel,

$$\frac{R_1R_2}{R_1 + R_2} = 1.5\ \Omega$$

∴ $R_1R_2 = 8 \times 1.5 = 12\ \Omega$

Now $(R_1 - R_2)^2 = (R_1 + R_2)^2 - 4R_1R_2$

∴ $(R_1 - R_2)^2 = (8)^2 - 4 \times 12$

or $(R_1 - R_2)^2 = 64 - 48 = 16$

or $R_1 - R_2 = 4\ \Omega$

On solving equations (i) and (iii), we get

$R_1 = 6\ \Omega$ and $R_2 = 2\ \Omega$

2. When a resistance of 3 ohm is connected a cross a cell, the current flowing is 0.5 A. On changing the resistance to 7 ohm, the current becomes 0.25 A. Calculate the e.m.f. and the internal resistance of the cell.

**Ans.** We know that,

$$I = \frac{E}{(R + r)}$$

∴ $$0.5 = \frac{E}{(3 + r)}$$

($\because$ I = 0.5 A when R = 3 Ω)

∴ $E = (3 + r) \times 0.5$ ...(i)

Also $$0.25 = \frac{E}{7 + r}$$

($\because$ I = 0.25 A when R = 7 Ω)

∴ $E = (7 + r) \times 0.25$ ...(ii)

Comparing equations (i) and (ii), we get

$(3 + r) \times 0.5 = (7 + r) \times 0.25$

∴ $1.5 + 0.5r = 1.75 + 0.25r$

∴ $0.25r = 0.25$

Internal resistance,

$r = 1\ \Omega$

Now, $E = I(R + r)$

∴ $E = 0.5\ (3 + 1)$

($\because$ I = 0.5 A when R = 3 Ω, r = 1 Ω)

∴ $E = 1.5 + 0.5 = 2\ V$

E.m.f. of the cell, E = 2 V

**Q – 4 Solve the following [House hold Electricity] [4]**

1. A house is provided with 15 bulbs of 40 W, 5bulbs of 100 W, 5 fans of 80 W and one heater of 1.0 kW. Each day bulbs are used for 4 h, fans for 10 h and heater for 2 h. The voltage of mains is 220 V. Calculate: (i) maximum power of the circuit in the house, (ii) maximum current capacity of the main fuse in the house, (iii) the electrical energy consumed in a week, (iv)cost of electricity consumed at 1.25 per kWh.

**Ans.** (i) Maximum power of the circuit

$= (40 \times 15) + (100 \times 5) + (80 \times 5) + (1000 \times 1)$

$= 600 + 500 + 400 + 1000$

$= 2500\text{ W} = 2.5\text{ kW}.$ **Ans.**

(ii) Maximum current capacity

$= \frac{\text{Total wattage}}{\text{Voltage of mains}} = \frac{2500}{220}$

$= 11.36$ (or $11.4$) A. **Ans.**

(iii) Electrical energy consumed in a week

In 40 W bulbs $= \frac{(40 \times 15) \times (4 \times 7)}{1000}$

$= 16.8$ kWh

In 100 W bulbs $= \frac{(100 \times 5) \times (4 \times 7)}{1000}$

$= 14$ kWh

In 80 W fans $= \frac{(80 \times 5) \times (10 \times 7)}{1000}$

$= 28$ kWh

In 1 kW heater $= \frac{(1000 \times 1) \times (2 \times 7)}{1000}$

$= 14$ kWh

$\therefore$ Total electrical energy consumed

$= 16.8 + 14 + 28 + 14$

$= 72.8$ kWh. **Ans.**

(iv) Cost of electricity $= 72.8 \times 1.25 =$ ₹ 91 **Ans.**



**Q – 5 Solve the following [Calorimetry] [3]**

1. 200g of hot water at 80°C is added to 300g of cold water at 10°C. Calculate the final temperature of the mixture of water. Consider the heat taken by the container to be negligible. (Specific heat capacity of water is 4200 Jkgl°c-]

**Ans.** Given: For hot water:

$m_1 = 200$ g, temperature, $t_1 = 80°C$

For cold water:

$m_2 = 300$ g, temperature, $t_2 = 10°C$

Let final temperature of mixture $= \theta$.

By the principle of calorimetry,

Heat given = Heat taken

$200 \times c \times (80 - \theta) = 300 \times c \times (\theta - 10)$

$200 \times 80 - 200\,\theta = 300\,\theta - 300 \times 10$

$16000 - 200\,\theta = 300\,\theta - 3000$

$19000 = 500\,\theta$

$\theta = 38°C$