

Specific Heat and energy questions

1. A 550 g rock is thrown 7.5 m in the air at a speed of 25 m/s. What is the mechanical energy of the rock?

$$P = mgh = 0.55 \times 9.8 \times 7.5 = 40.5 \text{ J}$$

$$K = \frac{1}{2}mv^2 = \frac{1}{2} \times 0.55 \times (25)^2 = 170.5 \text{ J}$$

$$40.5 \text{ J} + 170.5 \text{ J} = 210 \text{ J}$$

2. A truck weighing 4500 kg speeds at 75 km/h. What is its kinetic energy?

$$K = \frac{1}{2}mv^2 = \frac{1}{2} \times 4500 \times \left(\frac{75 \times 1000}{3600}\right)^2 = 9.9 \times 10^5 \text{ J}$$

3. What is the specific heat of oil if 500.0 g is heated from 10°C to 70°C and 45 000 J of heat was absorbed?

$$C = \frac{Q}{m\Delta T} = \frac{45000}{500.0 \times 60} = 2 \text{ J/g} \cdot ^\circ\text{C}$$

4. What is the heat energy of 60 g of water with a change in temperature of 25°C?

$$Q = mc\Delta T = 60 \times 4.19 \times 25 = 6000 \text{ J}$$

5. What is the speed of a rock when it reaches the water if it dropped 45.0 m from a mountain and it weighs 7.5 kg?

$$v^2 = \frac{K}{\frac{1}{2}m} = \frac{7.5 \times 9.8 \times 45.0}{\frac{1}{2} \times 7.5} = 1882 \Rightarrow 30 \text{ m/s} = 3.0 \times 10^1 \text{ m/s}$$

6. What is the potential energy of a ball if it is 7.0 m high and weighs 700 g?

$$P = mgh = 0.7 \times 9.8 \times 7.0 = 50 \text{ J}$$

7. What is the final temperature of water if 450 ml absorbs 17 600 J of heat and has an initial temperature of 60.0°C?

$$FT = IT + \Delta T$$

$$60.0 + 9.3 = 69.3 \text{ } ^\circ\text{C}$$

$$\Delta T = \frac{Q}{mc} = \frac{17600}{450 \times 4.19} = 9.3 \text{ } ^\circ\text{C}$$

8. What is the height of a ball which weighs 7.5 kg and has a potential energy of 5 500 J?

$$h = \frac{P}{mg} = \frac{5500}{7.5 \times 9.8} = 75 \text{ m}$$