YEAR 11 PHYSICS SEMESTER 2 TEST 1. W-86

CONSTANTS: Latent heat of fusion (water) = $3{\cdot}35 \times 10^5$ J kg^{-1}

Latent heat of vapourization (water) = $2{\cdot}25 \times 10^6$ J kg^{-1}.

1. Liquid sodium is used to transfer heat in some nuclear reactors. What is the main method of heat transfer in the reactor and why is the liquid sodium used in preference to water? (3)

2. Distinguish between heat and temperature. (2)

3. How much heat is absorbed by a 2·80 kg brick sitting in the sun while its temperature rises from 18·0°C to 28·0°C? (Specific heat of the brick is $7{\cdot}50 \times 10^2$ J kg^{-1} K^{-1}). (3)

4. A lump of lead is dropped from a height of 50·0m. If 60·0% of the energy it has on impact is converted into heat, calculate the temperature rise of the lead. (Specific heat of lead is $1{\cdot}30 \times 10^2$ J kg^{-1} K^{-1}). (4)

5. A 50·0 g copper calorimeter contains 85·0 g of water at 16·0°C. 6·00 g of ice is added, and the contents stirred until all the ice has melted. What will be the final temperature of the mixture? (4)
(Specific heat of water is $4{\cdot}18 \times 10^3$ J kg^{-1} K^{-1}).
" " " copper " $3{\cdot}90 \times 10^2$ J kg^{-1} K^{-1}

6. Explain why salt is thrown onto icy roads to clear them. (2)

7. Draw a heating curve for water, from −2·00°C to 105°C. (3).

8. 1·00 kg of steam at 100°C is blown onto a large block of ice. How much of the ice melts? (Assume not all of the ice melts). (4)

TOTAL: 25.

1. The main method of heat transfer is convection.
Liquid sodium is used because it has a very high boiling point and so remains liquid at the operating temperatures within the reactor. Also, it absorbs heat readily since its specific heat is high. (3)

2. Heat: sum of the potential and kinetic energies of the particles.
Temperature: a measure of the average kinetic energy of the particles. (2)

3. $Q = mc\Delta T$
$= (2.80)(7.50\times10^2)(10.0)$
$= 2.10\times10^4$ J.
∴ the brick absorbs 2.10×10^4 J of energy. (3)

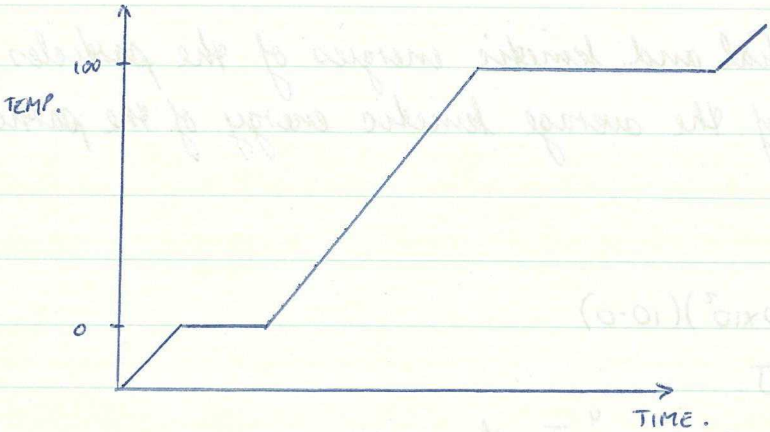
4. $Q = 60.0\% \, E_p$.
ie. $0.600\,mgh = mc\Delta T$
$\Rightarrow \Delta T = \frac{0.600gh}{c}$
$= \frac{(0.600)(9.80)(50.0)}{1.30\times10^2}$
$= 2.262\,^\circ C$.
∴ the temperature rise of the lead is $2.26\,^\circ C$. (4)

5. $Q_{lost} = Q_{gained}$

$\Rightarrow m_{cu} c_{cu} \Delta T + m_w c_w \Delta T = m_i L_f + m_i c_w \Delta T$.
$\Rightarrow (0.0500)(3.90\times10^2)(16.0 - T) + (0.085)(4.18\times10^3)(16.0 - T) = (0.00600)(3.35\times10^5) + (0.00600)(4.18\times10^3)(T - 0)$
$\Rightarrow 312 - 19.5T + 5684.8 - 355.3T = 2010 + 25.08T$
$\Rightarrow 399.88T = 3986.8$
$\Rightarrow T = 9.970\,^\circ C$.
∴ the final temperature of the mixture is $9.97\,^\circ C$. (4)

6. Salt lowers the melting point of ice to be below that of the existing atmospheric temperature. That is, if the air temp. is $-5.00°c$ and the melting point has been lowered to $-10.0°c$, then the ice present would melt. (2)

7.



(3)

8. $$Q_{lost} = Q_{gained}.$$

$$m_s L_v + m_s c_w \Delta T = m_i L_f$$

$$\Rightarrow (1.00)(2.25\times10^6) + (1.00)(4.18\times10^3)(100-0) = m_i \, (3.35\times10^5)$$

$$\Rightarrow \quad 2.668\times10^6 = m_i \, 3.35\times10^5$$

$$\Rightarrow \quad m_i = 7.964 \text{ kg}.$$

$\therefore$ 7.96 kg of ice would melt. (4)

TOTAL: $\overline{25}$.