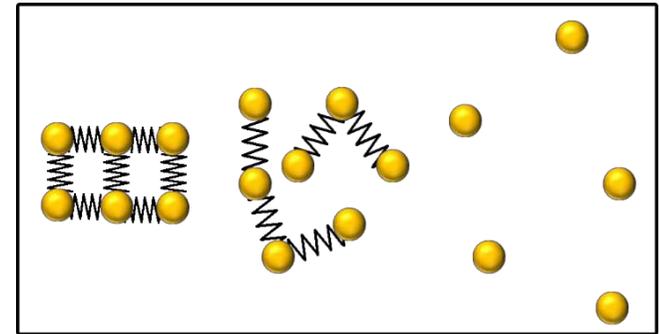
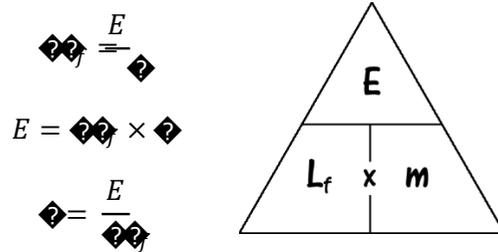
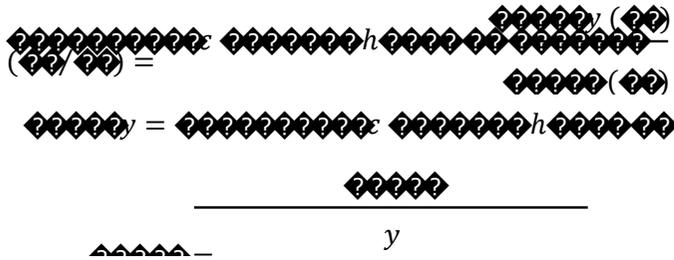


SPECIFIC LATENT HEAT

The specific latent heat of a substance tells us how much energy is required to change 1 kg from a solid to a liquid (specific latent heat of fusion) or from a liquid to a gas (specific latent heat of vaporisation).



WORKED EXAMPLE

QUESTION

398 J of energy is needed to turn 500 g of liquid nitrogen into at gas at -196°C . Calculate the specific latent heat of vaporisation of nitrogen.

ANSWER

Step 1: Write down what you know, and what you want to know.

$$E = 398 \text{ J}$$

$$m = 500 \text{ g} = 0.5 \text{ kg}$$

$$L_v = ?$$

Step 2: Use the triangle to decide how to find the answer - the specific latent heat of vaporisation.

Step 3: Use the figures given to work out the answer.

$$L_v = \frac{398 \text{ J}}{0.5 \text{ kg}} = 796 \text{ J/kg}$$

The specific latent heat of vaporisation of nitrogen is 796 J/kg (0.796 kJ/kg)

UNITS

The standard units of specific latent heat are J/kg

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ g} = 0.001 \text{ kg}$$

joules

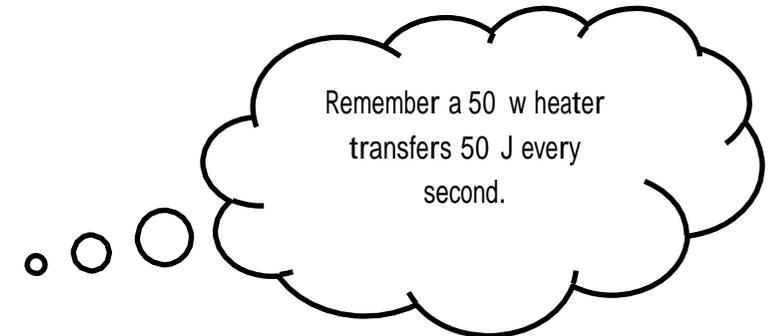
$$1 \text{ kJ} = 1000 \text{ J}$$

$$1 \text{ J} = 0.001 \text{ kJ}$$

Questions

1. Calculate the specific latent heat of fusion if:
 - a. 28 000 J is supplied to turn 2 kg of solid oxygen into a liquid at -219°C
 - b. 183 600 J is supplied to turn 3.4 kg of solid sulphur into a liquid at 115°C

- c. 6600 J is supplied to turn 600g of solid mercury into a liquid at -39°C
- d. 67 000 J is supplied to turn 200 g of ice into a liquid at 0°C
2. Calculate the specific latent heat of vaporisation if:
- a. 335 200 J is supplied to turn 400 g of liquid ethanol into a gas at 78°C
- b. 987 800 J is supplied to turn 2.2 kg of liquid hydrogen into a gas at -253°C
- c. 53.25 kJ is supplied to turn 250 g of liquid oxygen into a gas at -183°C
- d. 7620 J is supplied to turn 30 g of liquid chloroform into a gas at 62°C
3. How much energy is needed to turn 2 kg of water, at 100°C into steam at 100°C ? [Specific latent heat of vaporisation of water = 2 260 000 J/kg.]
4. How much heat energy is given out when 500 g of steam at 100°C condenses at 100°C ?
5. What mass of oxygen can be boiled if, 138 450 J of energy is supplied to liquid oxygen at -183°C ? [Specific latent heat of vaporisation of oxygen = 213 kJ/kg]
6. In an experiment to find the specific latent heat of fusion, 0.024 kg water was collected in a beaker in 300 s with the heater turned off. The beaker was emptied and placed under the funnel again. With the heater turned on for exactly 300 s, the joule meter reading increased from zero to 15 000 J and 0.068 kg of water was collected in the beaker.
- a. Calculate the mass of ice melted because of the heater being turned on.
- b. Use the data to calculate the specific latent heat of fusion of water.
7. How long will it take a 50 W heater to melt 2 kg of ice at 0°C ?
[Specific latent heat of fusion of ice = 335 000 J/kg.]
8. When a falling hailstone is at a height of 2.00 km its mass is 2.50 g.



- a. What is its potential energy?
- b. Assuming that all of this potential energy is converted to latent heat during the fall, calculate the mass of the hailstone that would melt while falling.
- c. Calculate the mass of the hailstone on reaching the ground.
[Specific latent heat of fusion of ice = 335 000 J/kg and the acceleration due to gravity to be 9.8 m/s^2].

