Essential Pre-Uni Physics G3.4

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of aluminium: $880\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of iron: $435\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of paraffin oil: $2130\,\mathrm{J\,kg^{-1}\,K^{-1}}$

These specific heat capacities can also be found within the hint tabs.

If $0.024\,\mathrm{kg}$ of water gets trapped in the shower heater of question G3.3, the thermal sensor must stop the current before the water reaches $80\,^{\circ}\mathrm{C}$. Assuming that the water is at $35\,^{\circ}\mathrm{C}$ when the fault occurs, how quickly must the thermal sensor act? Give your answer in seconds.

Essential Pre-Uni Physics G3.7

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of aluminium: $880\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of iron: $435\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of paraffin oil: $2130\,\mathrm{J\,kg^{-1}\,K^{-1}}$

These specific heat capacities can also be found within the hint tabs.

How much water at $52\,^{\circ}\mathrm{C}$ must I add to $19\,\mathrm{kg}$ of water at $21\,^{\circ}\mathrm{C}$ to make it the right temperature, $37\,^{\circ}\mathrm{C}$ for me to bath a baby?

Essential Pre-Uni Physics G3.2

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of aluminium: $880\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of iron: $435\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of paraffin oil: $2130\,\mathrm{J\,kg^{-1}\,K^{-1}}$

These specific heat capacities can also be found within the hint tabs.

How much time will it take a $2300\,\mathrm{W}$ kettle to heat $2.31\,\mathrm{kg}$ of water from $12\,^{\circ}\mathrm{C}$ to $100\,^{\circ}\mathrm{C}$? Assume no heat is lost to the surroundings. Give your answer in seconds. Give your answer to 2 significant figures.

Essential Pre-Uni Physics G3.3

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of aluminium: $880\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of iron: $435\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of paraffin oil: $2130\,\mathrm{J\,kg^{-1}\,K^{-1}}$

These specific heat capacities can also be found within the hint tabs.

How much water can a shower head heat each second from $12\,^{\circ}\mathrm{C}$ to $41\,^{\circ}\mathrm{C}$ if the heater has a power of $4200\,\mathrm{W}$? Assume that no heat is lost to the surroundings, and give your answer in kilograms.

Essential Pre-Uni Physics G3.1

GCSE A Level

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of aluminium: $880\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of iron: $435\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of paraffin oil: $2130\,\mathrm{J\,kg^{-1}\,K^{-1}}$

These specific heat capacities can also be found within the hint tabs.

Complete the values in the table below.

Energy / J	Material	Mass / kg	Initial Temperature / $^\circ\mathrm{C}$	Final Temperature / $^\circ\mathrm{C}$
(a)	Aluminium	0.290	15	82
45200	Paraffin	2.30	3.0	**(b)**
81000	Water	1.50	11	**(c)**

Part A Aluminium

a) What is the energy required?

Part B Paraffin

b) What is the final temperature in $^\circ\mathrm{C}$?

Part C Water

c) What is the final temperature in $^\circ\mathrm{C}$?

Essential Pre-Uni Physics G4.4

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of ice: $2030\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific latent heat of fusion of ice: $3.35 \times 10^5\,\mathrm{J\,kg^{-1}}$
- Specific latent heat of vaporization of water: $2.26 \times 10^6\,\mathrm{J\,kg^{-1}}$

In all questions, assume that the heat capacities given above remain constant at all temperatures.

$2.25\,\mathrm{kg}$ of ice, initially at $-40\,^\circ\mathrm{C}$, is heated using a $3.2\,\mathrm{kW}$ heater without loss to the surroundings.

Part A Time to reach melting point

How much time elapses before the ice reaches melting temperature? Give your answer in seconds.

Part B Time to melt

How much more time elapses before the ice has all melted (after it has reached melting temperature)? Give your answer in seconds.

Part C Time to reach boiling point

How much more time elapses before the water reaches boiling point? Give your answer in seconds.

Part D Time to vaporize

How much more time elapses before the water has all vaporized? Give your answer in seconds.

Essential Pre-Uni Physics G4.5

GCSE A Level

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of ice: $2030\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific latent heat of fusion of ice: $3.35 \times 10^5\,\mathrm{J\,kg^{-1}}$
- Specific latent heat of vaporization of water: $2.26 \times 10^6\,\mathrm{J\,kg^{-1}}$

In all questions, assume that the heat capacities given above remain constant at all temperatures.

A mass of $0.35\,\mathrm{kg}$ of ice at $-15\,^\circ\mathrm{C}$ is lowered into an insulated beaker containing $0.61\,\mathrm{kg}$ of water at $59\,^\circ\mathrm{C}$.

Part A Equilibrium temperature

What is the temperature after equilibrium has been reached? Give your answer in $^\circ\mathrm{C}$

Part B Minimum mass of water for $0.0\,^\circ\mathrm{C}$

What is the minimum mass of water at $59\,^\circ$ needed in the beaker to achieve a final temperature of $0.0\,^\circ\mathrm{C}$?

Part C Maximum mass of water for $0.0\,^\circ\mathrm{C}$

What is the maximum mass of water at $59\,^\circ$ that could be present in the beaker to achieve a final temperature of $0.0\,^\circ\mathrm{C}$?

Essential Pre-Uni Physics G4.2

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of ice: $2030\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific latent heat of fusion of ice: $3.35 \times 10^5\,\mathrm{J\,kg^{-1}}$
- Specific latent heat of vaporization of water: $2.26 \times 10^6\,\mathrm{J\,kg^{-1}}$

In all questions, assume that the heat capacities given above remain constant at all temperatures.

Part A Initial temperature

A certain quantity of ice requires $10.0\,\mathrm{J}$ to warm it to melting temperature. It then requires $100\,\mathrm{J}$ to melt it. Calculate the initial temperature of the ice in $^\circ\mathrm{C}$, assuming no heat loss to the surroundings.

Part B Final temperature

The water at freezing point in Part A is then heated using a further $100\,\mathrm{J}$. What is its final temperature? Give your answer in $^\circ\mathrm{C}$

Essential Pre-Uni Physics G4.1

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of ice: $2030\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific latent heat of fusion of ice: $3.35 \times 10^5\,\mathrm{J\,kg^{-1}}$
- Specific latent heat of vaporization of water: $2.26 \times 10^6\,\mathrm{J\,kg^{-1}}$

In all questions, assume that the heat capacities given above remain constant at all temperatures.

Part A Frozen pipe

A frozen pipe contains $5.60\,\mathrm{kg}$ of ice. How much energy is needed to melt it without changing its temperature?

Part B Warming and melting

If the ice were initially at $-3.5\,^\circ\mathrm{C}$, how much energy would be taken to warm it to melting point and then melt it?

Essential Pre-Uni Physics G3.8

GCSE C C C A Level P P P

- Specific heat capacity of water: $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of aluminium: $880\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of iron: $435\,\mathrm{J\,kg^{-1}\,K^{-1}}$
- Specific heat capacity of paraffin oil: $2130\,\mathrm{J\,kg^{-1}\,K^{-1}}$

These specific heat capacities can also be found within the hint tabs.

If I add $210\,\mathrm{g}$ of rivets at $303\,^{\circ}\mathrm{C}$ made of some unknown metal to $500\,\mathrm{g}$ of water at $15\,^{\circ}\mathrm{C}$, and the final temperature is $34\,^{\circ}\mathrm{C}$, what is the specific heat capacity of the mystery metal? Give your answer to 2 significant figures.