

# Essential Pre-Uni Physics G3.4



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

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



- Specific heat capacity of water:  $4180\,\mathrm{J\,kg^{-1}\,K^{-1}}$
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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



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

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.



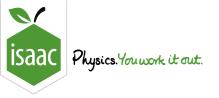
# Essential Pre-Uni Physics G3.3



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

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.



<u>Home</u> **Physics** 

Thermal **Heat Capacity**  Essential Pre-Uni Physics G3.1

# Essential Pre-Uni Physics G3.1



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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**

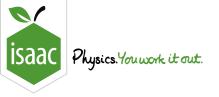
a) What is the energy required?

#### Part B **Paraffin**

b) What is the final temperature in °C?

### Part C Water

c) What is the final temperature in °C?



Home Physics

Thermal

**Heat Capacity** 

Essential Pre-Uni Physics G4.4

## Essential Pre-Uni Physics G4.4



- 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:  $3.35 \times 10^5 \, J \, kg^{-1}$
- ullet Specific latent heat of vaporization of water:  $2.26 imes 10^6~J~kg^{-1}$

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

 $2.25\,\mathrm{kg}$  of ice, initially at  $-40\,\mathrm{^{\circ}C}$ , 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

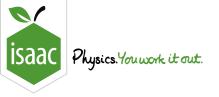
How much more time elapses before the ice has all melted (after it has reached melting temperature)? Give your answer in seconds.

### 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



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

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 °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  $0.0^{\circ}C$ ?



# Essential Pre-Uni Physics G4.2



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- Specific latent heat of fusion of ice:  $3.35 \times 10^5 \, J \, kg^{-1}$
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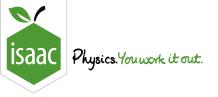
In all questions, assume that the heat capacities given above remain constant at all temperatures.

### 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



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- Specific latent heat of fusion of ice:  $3.35\times 10^5\,J\,kg^{-1}$
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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



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- Specific heat capacity of paraffin oil:  $2130\,J\,kg^{-1}\,K^{-1}$

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.