Specific Heat Capacity Questions for GCSE Physics

1. A block of metal has a mass of 2 kg. How much energy is required to raise its temperature by 5°C if its specific heat capacity is 400 J/kg°C?

$\Delta E = m\ c\ \Delta\theta$

$= 2 \times 400 \times 5$

$=$ **4000 J**

2. A kettle heats 1.5 kg of water from 20°C to 100°C. The specific heat capacity of water is 4,200 J/kg°C. How much energy is required?

$\Delta E = m\ c\ \Delta\theta$

$= 1.5 \times 4200 \times (100 - 20)$

$= 1.5 \times 4200 \times 80$ $=$ **504,000 J**

3. How much energy is required to heat 1.2 kg of copper from 15°C to 75°C, if the specific heat capacity of copper is 385 J/kg°C?

$\Delta E = m\ c\ \Delta\theta$

$= 1.2 \times 385 \times (75 - 15)$

$= 1.2 \times 385 \times 60 =$ **27,720 J**

4. A 4 kg block of iron is heated from 30°C to 80°C using 19,250 J of energy. What is the specific heat capacity of iron?

$\Delta E = m\ c\ \Delta\theta$

$19{,}250 = 4 \times c \times (80 - 30)$

$19{,}250 = 4 \times c \times 50$

$19{,}250 = 200 \times c$

$19{,}250 / 200 = c$

$=$ **385 J/kg°C**

5. A 0.3 kg aluminum block is heated by 1400 J of energy, and its temperature rises by 5°C. Calculate the specific heat capacity of aluminum.

$\Delta E = m\ c\ \Delta\theta$

$1400 = 0.3 \times c \times 5$

$1400 = 1.5 \times c$

$1400 / 1.5 = c$ $=$ **933 J/kg°C**

6. How much energy would be required to raise the temperature of 3 kg of iron from 20°C to 50°C, if the specific heat capacity of iron is 450 J/kg°C?

$\Delta E = m\ c\ \Delta\theta$

$= 3 \times 450 \times (50 - 20)$

$= 3 \times 450 \times 30 =$ **40,500 J**

7. A material with a specific heat capacity of 840 J/kg°C and a mass of 0.5kg releases 1,260J of energy as it cools. By how many degrees Celsius will its temperature decrease?

$\Delta E = m\ c\ \Delta\theta$

$1260 = 0.5 \times 840 \times \Delta\theta$ $\quad$ $1260 / 420 = \Delta\theta$

$1260 = 420 \times \Delta\theta$ $\quad$ = **3.0ºC**

8. Calculate the energy needed to raise the temperature of 500 g of water by 10°C. The specific heat capacity of water is 4,200 J/kg°C.

$\Delta E = m\ c\ \Delta\theta$ $\quad$ *[500g = 0.500kg]*

$= 0.500 \times 4200 \times 10$

= **21,000 J**

9. If you supply 1,260 J of energy to 0.5 kg of a material with a specific heat capacity of 840 J/kg°C, by how many degrees Celsius will its temperature increase?

$\Delta E = m\ c\ \Delta\theta$

$1260 = 0.5 \times 840 \times \Delta\theta$ $\quad$ $1260 / 420 = \Delta\theta$

$1260 = 420 \times \Delta\theta$ $\quad$ = **3.0ºC**

10. A 500 g sample of a metal absorbs 1,800 J of energy, and its temperature increases from 25°C to 55°C. Determine the metal's specific heat capacity.

$\Delta E = m\ c\ \Delta\theta$ $\quad$ *[500g = 0.500kg]*

$1800 = 0.500 \times c \times (55 - 25)$

$1800 = 0.500 \times c \times 30$ $\quad$ $1800 / 15 = c$

$1800 = 15 \times c$ $\quad$ = **120 J/kgºC**

11. A 1.5 kg block of lead is heated, and its temperature increases by 30°C after absorbing 5,400 J of energy. Find the specific heat capacity of lead.

$\Delta E = m\ c\ \Delta\theta$

$5400 = 1.5 \times c \times 30$ $\qquad$ $5400 / 45 = c$

$5400 = 45 \times c$ $\qquad$ = **120 J/kg°C**

12. A hot water tank contains 100 kg of water at 20°C. How much energy is required to raise the temperature of the water to 80°C, given the specific heat capacity of water is 4,200 J/kg°C?

$\Delta E = m\ c\ \Delta\theta$

$= 100 \times 4200 \times (80 - 20)$

$= 100 \times 4200 \times 60$ = **25,200,000 J** **(or 25.2 MJ)**

13. How much energy is required to heat a 5 kg steel block (specific heat capacity = 450 J/kg°C) from 50°C to 200°C?

$\Delta E = m\ c\ \Delta\theta$

$= 5 \times 450 \times (200 - 50)$

$= 5 \times 450 \times 150$ = **337,00J**

14. What is the maximum mass of water that can be heated from 21°C to 35°C by 35kJ? Take the specific heat capacity of water to be 4200 J/kg°C

$\Delta E = m\ c\ \Delta\theta$ $\qquad$ *[35 kJ = 35,000 J]*

$35,000 = m \times 4200 \times (35 - 21)$ $\qquad$ $35,000 = m \times 58,800$

$35,000 = m \times 4200 \times 14$ $\qquad$ $35,000 / 58,000$ = **0.595 kg**

15. A 250 g copper block is heated by 1,000 J of energy, and its temperature rises by 15°C. Determine the specific heat capacity of copper.

$\Delta E = m\ c\ \Delta\theta$ $\qquad$ *[250 g = 0.250 kg]*

$1000 = 0.25 \times c \times 15$

$1000 = 3.75 \times c$

$1000 / 3.75 = c$ = **267 J/kg°C**