

Conduction Practice Problems:

1.

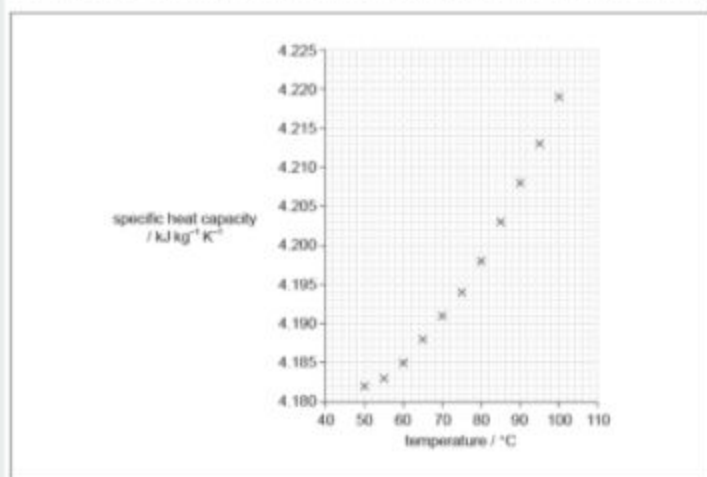
A sealed container contains water at 5 °C and ice at 0 °C. This system is thermally isolated from its surroundings. What happens to the total internal energy of the system?

- A. It remains the same.
- B. It decreases.
- C. It increases until the ice melts and then remains the same.
- D. It increases.

#1 Answer = A

2.

In an experiment, data were collected on the variation of specific heat capacity of water with temperature. The graph of the plotted data is shown.



The uncertainty in the values for specific heat capacity is 5%.

Water of mass (100 ± 2) g is heated from (75.0 ± 0.5) °C to (85.0 ± 0.5) °C.

- a. Draw the line of best-fit for the data. [1]
- b.i. Determine the gradient of the line at a temperature of 80 °C. [3]
- b.ii. State the unit for the quantity represented by the gradient in your answer to (b)i). [1]
- c.i. Calculate the energy required to raise the temperature of the water from 75 °C to 85 °C. [1]
- c.ii. Using an appropriate error calculation, justify the number of significant figures that should be used for your answer to (c)i). [3]

#2 Solution:

a. single smooth curve passing through all data points

Do not accept straight lines joining the dots

Curve must touch some part of every x

b.i.tangent drawn at 80 °C

gradient values separated by minimum of 20 °C

9.0×10^{-4} «kJ kg⁻¹ K⁻²»

Do not accept tangent unless "ruler" straight.

Tangent line must be touching the curve drawn for MP1 to be awarded.

Accept values between 7.0×10^{-4} and 10×10^{-4} .

Accept working in J, giving 0.7 to 1.0

b.ii.kJ kg⁻¹ K⁻²

b.ii.kJ kg⁻¹ K⁻²

Accept J instead of kJ

Accept °C⁻² instead of K⁻²

Accept °C⁻¹ K⁻¹ instead of K⁻²

Accept C for °C

c.i.«0.1 x 4.198 x 10 => 4.198 «kJ» **or** 4198 «J»

Accept values between 4.19 and 4.21

c.ii.percentage uncertainty in $\Delta T = 10\%$

«2% + 5% + 10%» = 17%

absolute uncertainty «0.17 x 4.198 => 0.7 «kJ» therefore 2 sig figs

OR

absolute uncertainty to more than 1 sig fig and consistent final answer

Allow fractional uncertainties in MP1 and MP2

Watch for ECF from (c)(i)

Watch for ECF from MP1

Watch for ECF from MP2

Do not accept an answer without justification

Convection Practice Problems:

3. How many types of convection are there?

- a) 4
- b) 3
- c) 2
- d) 1

#3 Answer: b

Explanation: It is of three types i.e. forced convection, natural convection and mixed convection.

4. Which of the following heat flow situations pertains to free or natural convection?

- a) Air conditioning installations and nuclear reactors
- b) Flow of water inside the condenser tubes
- c) Cooling of internal combustion engine
- d) Cooling of billets in atmosphere

#4 Answer: d

Explanation: Cooling of billets in the atmosphere is both free and natural convection.

5. A body cooling from 80 degree Celsius to 70 degree Celsius takes 10 minutes when left exposed to environmental conditions. If the body is to cool further from 70 degree Celsius to 60 degree Celsius under the same external conditions, it will take

- a) Same time of 10 minutes
- b) More than 10 minutes
- c) Less than 10 minutes
- d) Time will depend upon the environmental conditions

#5 answer: b

Explanation: $Q = h A (t_b - t_a)$. Apparently, the cooling depends upon the same temperature difference.

Radiation Practice Problems:

6.

X and Y are spherical black bodies that radiate the same power. The temperature of X is 350 K and the temperature of Y is 700 K.

What is the ratio $\frac{\text{radius of X}}{\text{radius of Y}}$?

A. 16

B. 4

C. $\frac{1}{4}$

D. $\frac{1}{16}$

#6 ANSWER = B

7.

Global warming reduces the ice and snow cover on Earth. Which of the following correctly describes the changes in albedo and rate of energy absorption by Earth?

	Albedo	Rate of energy absorption
A.	increase	increase
B.	decrease	increase
C.	increase	decrease
D.	decrease	decrease

#7 ANSWER = B