Christ Church Grammar School

Science Department
Year 11 2021

ATAR PHYSICS
UNIT 1 THERMAL PHYSICS
VALIDATION TEST 2021

Student Name: _____

Teacher: JRM PCW CJO
(Please circle)

Time allowed for this paper
Working time for paper: 35 minutes

Instructions to candidates:

- You must include **all** working to be awarded full marks for a question. Answers should be expressed to 3 significant figures unless otherwise indicated.
- Marks may be deducted if diagrams are not drawn neatly with a ruler and to scale (if specified).
- Marks will be deducted for incorrect or absent units.
- **No** graphics calculators are permitted – scientific calculators only.

Mark:	/ 38
=	%

Question 1 **(3 marks)**

Explain how a kilogram of one substance can have more internal energy than a kilogram of another substance even though they are at the same temperature.

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Question 2 **(5 marks)**

Consider the image below of two readings (in degrees Celsius) made by the same thermometer.

(a) Enter the measurements into the table below including a measure of uncertainty.

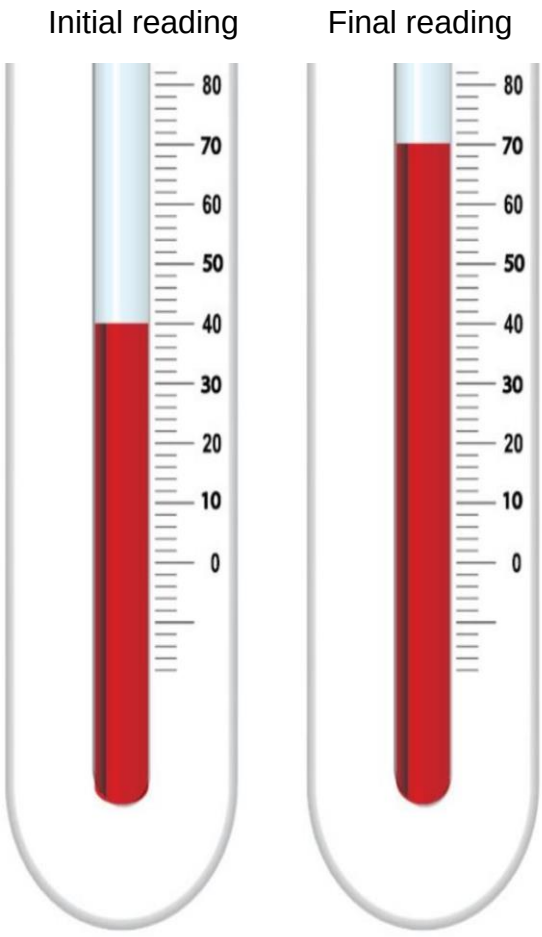
(2 marks)

(b) Convert the measurements in the first column to kelvin. Place your answer in the final column. (1 mark)

	Measurement (°C)	Uncertainty (°C)	Measurement (K)
Initial temperature			
Final temperature			
Change in temperature			

(c) Calculate the percentage uncertainty of the change in temperature

(2 marks)



Question 3 **(5 marks)**

A 1.00 $\pm$ 0.05 kg brick initially at 25.0 $\pm$ 0.5 °C is left out in the sun where it absorbs 2.40 $\pm$ 0.10 kJ of heat. Calculate the change in temperature of the brick including a measure of absolute uncertainty.

c_{brick} = 7.50 x10^2 J kg^{-1} K^{-1}

Question 4 **(6 marks)**

A 50.0 W heating element is placed in 0.350 kg of water at 15.0 °C. The element is turned on and increases the temperature to 34.4 °C.

(a) Complete the table below by adding terms such as “increasing, decreasing or constant” to explain what is happening to the water while the heating element is heating it.

(3 marks)

Property of water	Consequence
Internal energy	
Mean translational kinetic energy	
Potential Energy of water	

(b) Calculate the time taken for the water to increase to 34.4 °C.

(3 marks)

Question 5 **(5 marks)**

State the definitions of the following terms:

(2 marks)

(a) Thermal Equilibrium: _____

_____

_____

(b) Heat: _____

_____

_____

Consider a spa containing 5.00 x10^2 kg of water at 30.0 °C and a cup of 0.400 kg of water at 70.0 °C.

(c) State and explain, making reference to the terms “heat” and “temperature”, the direction that thermal energy would flow if a person was to place his hand (of surface temperature 35.0 °C) in both bodies of water.

(3 marks)

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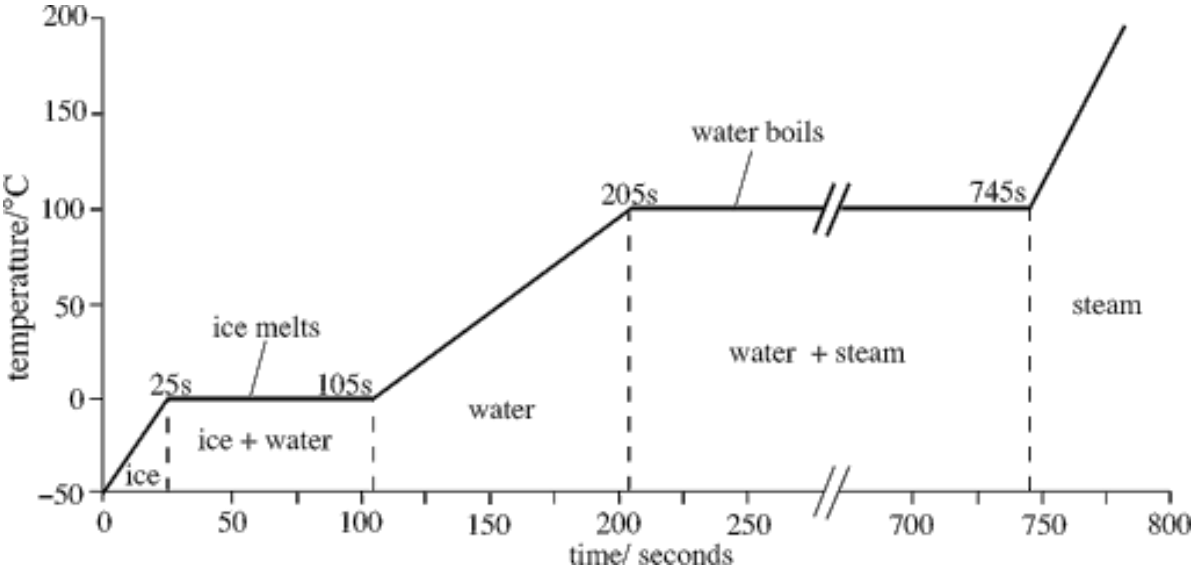
Question 6 **(9 marks)**

Consider the heating curve of 0.100 kg of water shown below.



(a) Calculate the energy required to fully melt the ice.

(3 marks)

(b) Calculate the energy required to heat the water from the 105 second mark to 205 second mark.

(3 marks)

(c) Using the values obtained in part (a) and (b), determine if heat is supplied at a constant rate throughout the heating curve.

(3 marks)

Question 7 **(5 marks)**

0.250 kg of water at 20.0 °C is placed into a 0.500 kg aluminium pan fresh off the stove with a temperature of 150 °C. Assuming that the pan is on an insulated pad and that no significant amount of water boils off, calculate the final temperature of the water and pan system.

c_{Al} = 900 J kg^{-1} K^{-1}

END OF TEST