Physics ATAR - Year 11

Thermal Physics Validation Test 2019

Name:	Mark: / 41 = %</td>

Time Allowed: 50 Minutes

Notes to Students:

1. You must include **all** working to be awarded full marks for a question.
2. Marks will be deducted for incorrect or absent units and answers stated to an incorrect number of significant figures.
3. **No** graphics calculators are permitted – scientific calculators only.

ADDITIONAL FORMULAE AND DATA

- Triple Point of Water = 0.01°C = 273.16 K
- $\frac{T_\theta}{100} = \frac{X_\theta - X_0}{X_{100} - X_0} = \frac{L_\theta - L_0}{L_{100} - L_0} = \frac{R_\theta - R_0}{R_{100} - R_0}$
- K = C + 273.15

Question 1 **(2 marks)**

Explain in terms of physical concepts, the temperature of “Absolute Zero”

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Question 2 **(3 marks)**

The air in the classroom is reduced from 25.0 °C to 288.0 K. Calculate the change in temperature in Kelvin.

Question 3 **(3 marks)**

The capillary length of an uncalibrated glass thermometer when placed in ice water is measured to 2.5 cm and 16.3 cm in boiling water. Calculate the length of the capillary would be when placed in air of 25.0 °C.

Question 4 **(3 marks)**

Calculate the amount of energy the needs to be removed from 1.55 kg of water to freeze it.

Question 5 **(4 marks)**

Substance A (with specific heat capacity c_A) and substance B (with specific heat capacity c_B) are both initially at 20.0 °C. Both have the same mass and are provided the same amount of heat. If substance A records a final temperature of 22.4 °C and substance B records a final temperature of 32.1 °C. Express the specific heat capacity of substance B in terms of c_A.

Question 6 **(6 marks)**

(a) State the definition of temperature

(1 mark)

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(b) State the definition of internal energy.

(1 mark)

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Consider a 0.1 kg sample of ice at 0 °C and a 0.1 kg sample of liquid water at 0 °C.

(c) Choose which volume of water has more internal energy (Circle your chosen answer)

(1 mark)

(i) The ice

(ii) The water

(iii) They both have the same amount of internal energy

(d) Explain your answer to (c).

(3 marks)

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Question 7 **(7 marks)**

A sample of water is measured to be 0.524 kg with a tolerance of $\pm$0.500 %. Its initial temperature is recorded at 14.5 °C and is then heated to 28.0 °C. The temperature is measured with an alcohol in glass thermometer with 1°C divisions.

(a) Calculate the amount of energy to heat the water to its final temperature.

(3 marks)

(c_w = 4180 $Jkg^{-1}K^{-1}$)

(b) Calculate the absolute uncertainty of the heat supplied to the water.

(4 marks)

Question 8 **(8 marks)**

A 0.150 kg mass of copper is immersed in an insulated 0.125 kg volume of water initially at 18.0 °C. The final temperature of the mixture is measured to be 24.4 °C.
(c_{Cu} = 390.0 $Jkg^{-1}K^{-1}$)
(c_w = 4180 $Jkg^{-1}K^{-1}$)

(a) Calculate the initial temperature of copper required to produce the final temperature.
(4 marks)

(b) State one assumption made in the above calculation.
(1 mark)

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(c) In reality, state and explain whether the required initial temperature of copper would be greater, less, or no difference to raise the temperature of the mixture to 24.4 °C.
(3 marks)

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Question 10 **(5 marks)**

0.055 kg of ice at -5.00 °C is placed into an aluminium calorimeter of mass 0.400 kg containing 0.340 kg of water, both initially at 30.0 °C. Calculate the resulting temperature of the mixture.

(c_{Al} = 890 $Jkg^{-1}K^{-1}$)
(c_w = 4180 $Jkg^{-1}K^{-1}$)
(c_{ice} = 2100 $Jkg^{-1}K^{-1}$)

END OF TEST