Physics
Christ Church Grammar School

Science Department
Year 11 2020

# ATAR PHYSICS
# UNIT 1 THERMAL PHYSICS VALIDATION TEST 2020

Student Name: _____

Teacher: JRM PCW JH SA
(Please circle)

**Time allowed for this paper**
Working time for paper: 30 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.

**ADDITIONAL FORMULAE AND DATA**

- Triple Point of water = 0.01°C = 273.16 K
- K = C + 273.15
- $Power = \frac{Energy}{time}$

| Mark: | / 32 |
|---|---|
| = | % |

**Question 1** **(3 marks)**

The words ‘heat’ and ‘temperature’ are often confused. In the space below, distinguish clearly between these two quantities using physics concepts covered in the course. In your answer, include the concept of internal energy.

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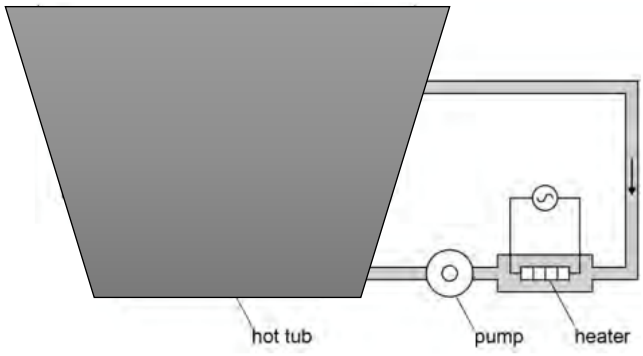
**Question 2** **(3 marks)**

The water placed in a freezer is reduced from 298.0 K to -12.0 °C. Calculate the change in temperature in degrees Celsius.

**Question 3** **(6 marks)**

The diagram below shows how the temperature of the water is maintained in a hot tub.




The hot tub system shown above has a volume of 1.50 $m^3$ and is filled with water at a temperature of 28.0 °C. The heater transfers thermal energy to the water at a rate of 2.70 kW while a pump circulates the water. Assume that no heat is transferred to the surroundings and 1.00 $m^3$ of water has a mass of 1.00 $x10^3$kg.

(a) Calculate the energy required in increase the water to 35.0 °C

(3 marks)

(b) Calculate the time in minutes that the heater would take to heat the water to 35.0 °C

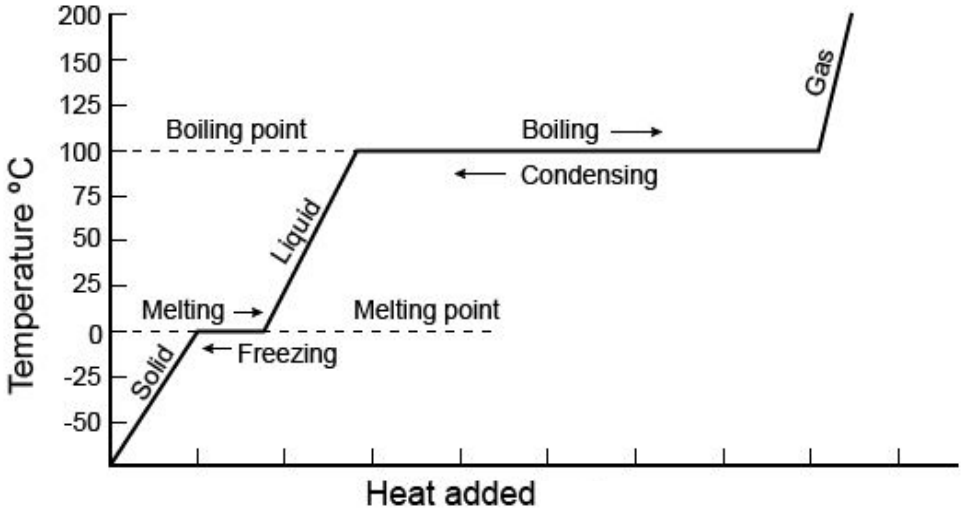
(3 marks)

**Question 4** **(3 marks)**

Provide the definition for the Triple Point of water and explain its significance in the Celsius scale.

**Question 5** **(4 marks)**

Consider the heating curve for a mass of water showing the temperature change as heat is supplied to it at a constant rate.




(a) Correctly label the x-axis (1 mark)

(b) Describe how the gradient of each phase (solid, liquid, gas) can be used to compare the specific heat capacity of each phase. (3 marks)

**Question 5** **(7 marks)**

An ice cube at 0.00 °C is placed into an insulated container with 151 g of water at 45.0 °C. In one minute, the ice cube had melted. The final mass of water in the glass was 175 g and the final temperature of the water was 28.0 °C.

(a) Using the data provided, calculate the latent heat of fusion of water.

(5 marks)

(b) Calculate the percentage error compared with the accepted value.

(2 marks)

**Question 6** **(5 marks)**

155 g of hot copper is immersed in an insulated 0.255 kg volume of water initially at 20.0 °C. The final temperature of the mixture is measured to be 24.4 °C. ($c_{Cu}$ = 390.0 $Jkg^{-1}K^{-1}$)

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

(b) State two assumptions made in the above calculation.
(2 mark)

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**END OF TEST**