ARANMORE CATHOLIC COLLEGE

YEAR 11 ATAR PHYSICS

TOPIC TEST 5: HEATING AND COOLING

**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ MARK:**

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| **/50** |

**INSTRUCTIONS:**

1. Answer ALL questions in the spaces provided.

2. **Show ALL working** clearly to obtain maximum marks, as shown in brackets.

3. A data/formulae sheet is provided

4. Use of an approved scientific calculator is permitted.

## QUESTIONS:

1. Kali installs a water wheel which is used to drive a turbine in order to generate electricity for a remote household. A hot water system is then connected to the turbine. The **combined** efficiency is determined to be 18%, which means that only 18% of the energy input to the water wheel is actually used to heat the water in the tank.

If the total energy of the moving water used to turn Kali’s water wheel is 176 MJ each hour, then what volume of water could be heated from 18ºC to 60ºC by Kali’s hot water system each hour? [3]

**2. (a)** Dan is planning to boil some eggs for breakfast. He pours 1.45 L of water into a stainless steel pan weighing 625 g. The water and the pan are initially at 25.0 ºC. He then places the pan on the stove, which delivers 5750 J of heat to the pan each second, and leaves the room. The pan will be damaged if it is allowed to boil dry. If Dan forgets to return to the pan and the water starts to boil away, how long can he be gone before any damage begins to be done? [5]

**(b)** How is heat transferred from the stove to the pan and then to the water, in the above situation? Use the Kinetic Theory in your explanation. [3]

**(c)** The heating will not be 100% efficient in any real situation - explain “efficiency” with reference to the above example. What effect will this have on the time it takes for all the water to boil from Dan’s pan? [2]

**3.** It is the summer holidays and Lily is sitting on the beach enjoying the sun, after a morning of fine surfing. Explain the difference in the rate of heating (and cooling) of sand to that of water, and hence why Lily feels a cool breeze blowing in from the sea around midday. On a very hot day, why is the cool breeze from the ocean even stronger? [3]

1. Mayen took an ice-pack (containing a substance that is liquid at room temperature) out of the freezer and put it into a cooler full of drink cans. Why is an ice-pack that is frozen solid when it is put in the cooler better at keeping drinks cold than one which is still liquid, even if both are at the same temperature? [2]
2. Explain why a person standing in a breeze is more likely to feel cold if their clothes are wet, rather than dry. [3]
3. Vy is hiking in the Himalayas with a few friends when they decide to stop for a cup of tea. Vy’s friend is surprised to find that when he boiled the water for the tea, it didn’t seem as hot as he expected. Vy then explained to her friend why the boiling water was at a lower temperature than 100° C. What is the explanation? [3]
4. Explain why water is commonly used as a coolant in engines and generators. [2]
5. Many modern ironing board covers are silver in colour. It is easier to remove creases from clothing when the material is hot. Explain how a silver coloured ironing board helps in ironing. [2]
6. Using the diagram below, explain why a thermos-flask can be used to keep a cold drink cold or a hot drink hot. [4]



1. At room temperature (22.0 ºC) and normal atmospheric pressure (101 kPa), a total volume of 4200 litres of LP gas is compressed into a 25.0 litre cylinder. What is the pressure of the gas in the cylinder immediately after the compression if the temperature of the cylinder initially increases to 57.5ºC? [3]
2. Spray paint cans and other pressure-packed cans carry a warning not to incinerate them even when there is no paint left. Explain why the manufacturers make this recommendation.

[3]

1. Cara uses calorimetry to determine the specific heat capacity of an oil. The copper calorimeter, of mass 125 g, contains 265 g of oil, both at 73 °C. Cara adds 30.0 g of ice at 0.00 °C and the final temperature of the mixture is 1.50 °C. Use this information to determine the specific heat capacity of the oil. Assume there is no heat loss to the surroundings. [5]
2. Andy fills an electric kettle with water at 15 °C, plugs it in and switches it on. It takes three and a half minutes for the water to begin to boil and it is left boiling for one minute before being switched off.

**a)** Use the grid below to draw a graph of temperature against time for the water in the kettle for a total of **seven minutes** from the time Andy switches the kettle on. [4]

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1. Explain the shape of your graph and describe the processes occurring in each of the three main sections of the graph.

[3]

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### END OF TEST