IB Physics SL Y2 – Paper 1 and Paper 2 Review – Topic 3 Assignment (19 Marks)

Name: _____ Date: _____ Period: _____

Objectives:
3.1 Thermal concepts
3.2 Thermal properties of matter

In the table below, which row shows the correct conversion between the Kelvin and Celsius temperature scales?

	Kelvin temperature / K	Celsius temperature / °C
A.	0	373
B.	100	–173
C.	173	100
D.	373	–100

Carbon has a relative atomic mass of 12 and oxygen has a relative atomic mass of 16. A sample of 6 g of carbon has twice as many atoms as

A. 32 g of oxygen.

B. 8 g of oxygen.

C. 4 g of oxygen.

D. 3 g of oxygen.

Tanya heats 100 g of a liquid with an electric heater which has a constant power output of 60 W. After 100 s the rise in temperature is 40 K. The specific heat capacity of the liquid in $Jkg^{-1}K^{-1}$ is calculated from which of the following?

A. $\frac{60\times100}{0.1\times40}$

B. $\frac{60\times0.1}{40}$

C. $\frac{0.1\times40}{60}$

D. $\frac{60}{40}$

A temperature of 23 K is equivalent to a temperature of

A. – 300 °C.

B. – 250 °C.

C. + 250 °C.

D. + 300 °C.

The ratio

$$\frac{\text{thermal capacity of a sample of copper}}{\text{specific heat capacity of copper}}$$

A. does not have any unit.

B. has unit $\text{J kg}^{-1}\ \text{K}^{-1}$.

C. has unit J kg^{-1}.

D. has unit kg.

In the kinetic model of an ideal gas, it is assumed that

A. the forces between the molecules of the gas and the container are always zero.

B. the intermolecular potential energy of the molecules of the gas is constant.

C. the kinetic energy of a given molecule of the gas is constant.

D. the momentum of a given molecule of the gas is constant.

In one particular make of electric kettle, the heater must always be immersed in water when the kettle is in use. The minimum volume of water that can be heated is 650 cm^3.

The kettle is used six times each day to boil water for a single cup of tea. The cup has a volume of 350 cm^3. The mass of 1.0 cm^3 of water is 1.0 g.

(i) Calculate the mass of water that is heated, but not used, during one day. *[1]*

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(ii) The initial temperature of the water in the kettle before heating is 18 °C. The specific heat capacity of water is $4.2 \times 10^3 \, J \, kg^{-1} \, K^{-1}$. Deduce that the electrical energy wasted each day is 6.2×10^5 J. *[1]*

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(iii) The cost of 1.0 MJ of electrical energy is 3.5 cents. Estimate the cost of the energy that is used each year to heat water that is not used to make tea. *[2]*

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The table below gives data for water and ice.

specific heat capacity of water	$4.2\,kJ\,kg^{-1}\,K^{-1}$
specific latent heat of fusion of ice	$330\,kJ\,kg^{-1}$

A beaker contains 450 g of water at a temperature of 24 °C. The thermal (heat) capacity of the beaker is negligible and no heat is gained by, or lost to, the atmosphere. Calculate the mass of ice, initially at 0 °C, that must be mixed with the water so that the final temperature of the contents of the beaker is 8.0 °C. *[4]*

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Solar radiation is incident on a pond of area $12\,m^2$. The pond is covered by a layer of ice of thickness 3.0 cm. The temperature of the ice is 0.0 °C.

(i) The density of ice is $900\,kg\,m^{-3}$. Deduce that the mass of ice on the pond is approximately 320 kg. *[2]*

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(ii) The average power per unit area incident on the ice over a period of 6.0 hours is $340\,W\,m^{-2}$. Deduce that the energy incident on the pond in this time is 8.8×10^7 J. *[1]*

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(iii) The specific latent heat of fusion of ice is $330\,kJ\,kg^{-1}$. Determine whether all the ice on the pond will melt in the 6.0 hour time period. *[2]*

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