PLK Vicwood K.T. Chong Sixth Form College
NSS Physics Revision Exercise for F.3 Students
Heat and Energy

Class: _____ Name: _____

Topic 1: Heat and Energy M.C. Section

1. Which of the following statements about energy are correct?

   (1) Energy is a substance.
   (2) The unit of energy is the joule.
   (3) Energy may be converted from one form into another.

   A. (1) and (2) only
   B. (1) and (3) only
   C. (2) and (3) only
   D. (1), (2) and (3)

2. The temperature of an object is a measure of

   A. the heat transferred from the object to another.
   B. the average potential energy of particles in the object.
   C. the average kinetic energy of particles in the object due to their random motion s.
   D. the internal energy of the object.

3. Arrange the average potential energies of particles in 1 kg of iron in different states in descending order.

   A. Liquid, gas, solid
   B. Gas liquid, solid
   C. Solid, liquid, gas
   D. Gas, solid, liquid

4. Which of the following factors does **NOT** affect the internal energy stored in a substance?

   A. Mass of the substance
   B. State of matter of the substance
   C. Temperature of the substance
   D. Colour of the substance

5. Which of the following objects has the greatest amount of internal energy?

   A. 50 g of melting ice at 0 °C
   B. 50 g of water at 0 °C
   C. 100 g of water at 0 °C
   D. 100 g of water at 20 °C

Answer for M.C.

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

Structure Question

6. Sandy pours some water from a water tank into a cup. Suppose the water temperature does not change. Comparing water molecules in the tank and the cup,

   (a) do they have the same average kinetic energy? Explain briefly. (2 marks)

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(b) do they have the same total kinetic energy? Explain briefly. (2 marks)

If necessary, take heat capacity of water = 4200 J kg^{-1} $°C^{-1}$

Topic 2.1: Heat Transfer

M.C. Section

1. An electric kettle has a power of 300 W. Find the amount of energy consumed by the kettle in 2 minutes.

   A. 25 J
   B. 6000 J
   C. 3.6×10^5 J
   D. 3.6×10^6 J

2. An induction cooker heats up a pot of water from 20°C to 80°C with a power of 1200 W in 6 minutes. If a microwave oven provides the same amount of energy in 5 minutes, what is the average power of the microwave oven?

   A. 1000 W
   B. 1250 W
   C. 1440 W
   D. 1600 W

1. _____ 2. _____

Structure Question

3. A light bulb consumes 14 400 J of energy in 30 minutes. What is the average power? (2 marks)

4. A chicken is roasted in an oven with a power of 1450 W. If 1.60×10^6 J of energy is required to roast the chicken, how long does it take? (2 marks)

5. An athlete runs and consumes energy at a rate of 240 W. Find the total energy consumed by her in 2 hours in
   (a) J. (2 marks)

(b) kW h. (2 marks)

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Topic 2.2: Heat capacity and specific heat capacity

1. What is the physical meaning of heat capacity of an object?

   A. The energy needed to increase the temperature of 1 kg of the object.
   B. The increase in temperature of the object when 1 J of energy is transferred to it.
   C. The energy released by the object when its temperature drops by 1 °C.
   D. The power of the heater required to increase the temperature of object by 1 °C.

2. Which of the following pairs of objects have the same heat capacity?

   A. 1 kg of water and 2 kg of water.
   B. 1 kg of water at 10 °C and 1 kg of water at 50 °C
   C. 1 kg of water and 1 kg of ice
   D. 1 kg of water and 1 kg of water vapour.

3. Jasmine heats up some corn soup with an 1.6 kW induction cooker for 2 minutes. If the heat capacity of the corn soup is 2650 J $°C^{-1}$, what is the increase in temperature of the soup? Assume there is no energy is gained from or loss to the surroundings.

   A. 48.3 °C B. 55.6 °C
   C. 72.5 °C D. 88.0 °C

4. There is 2 kg of water. Which of the following statements is correct?

   A. The heat capacity of 1 kg of water is 2100 J $°C^{-1}$.
   B. A 100 W heater takes 42 s to heat up the water by 1 °C.
   C. The internal energy of the water is 8400 J
   D. The water's temperature will increase by 1 °C when its internal energy increased by 8400 J.

5. If 1 kg of each of the following substances gains the same amount of internal energy, which of them has the greatest temperature change?

	Substance	Specific heat capacity / J kg^{-1} $°C^{-1}$
A.	Ice	2100
B.	Aluminium	900
C.	Dry Ice	850
D.	Lead	130

6. When a 1.4 kg iron block gains 3500 J of internal energy, its temperature increases by 5.5 °C. Find the specific heat capacity of iron.

   A. 455 J kg^{-1} $°C^{-1}$
   B. 636 J kg^{-1} $°C^{-1}$
   C. 890 J kg^{-1} $°C^{-1}$
   D. 2500 J kg^{-1} $°C^{-1}$

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

6. _____

Structure Question

7. Donald heats up a pot of tea for 6 minutes using an immersion heater. The power of the heater is 10 W. (Given: heat capacity of the tea = 900 J $°C^{-1}$)

   (a) If the initial temperature of the tea is 2 °C, what is the final temperature? Assume no energy is gained from or lost to surroundings, (2 marks)

   (b) The tea's final temperature is measured to be 7 °C. Suggest why it differs from the value found in (a). (2 marks)

8. The specific heat capacity of brass is 380 J kg^{-1} $°C^{-1}$.

   (a) What is the heat capacity of 3 kg of brass? (2 marks)

   (b) How much energy is required to increase the temperature of 3 kg of brass by 40°C? (2 marks)

Topic 2.3: Mixing substances with different temperature

1. Hot water at 80°C is mixed with some coffee powder at 20°C in a cup. If the heat capacity of the water is greater than that of the coffee powder, what is the temperature of the mixture? Assume the heat capacity of the cup and the energy gained from or lost to surroundings are negligible.

   A. Lower than 20 °C
   B. Between 20 °C and 50 °C
   C. 50 °C
   D. Between 50 °C and 80 °C

2. Equal mass of liquids *X* and *Y* at 80 °C and 40 °C respectively are mixed together. The temperature of the mixture is 60 °C. Assuming no energy is gained from or lost to the surroundings, which of the following deductions is **NOT** correct?

   A. The specific heat capacity of *X* is the same as that of *Y*.
   B. The heat capacity of *X* is the same as that of *Y*.
   C. When the temperature is steady, the average kinetic energy of the particles of *X* is the same as that of *Y*.
   D. The energy released by liquid *X* is greater than the energy gained by liquid *Y*.

1. _____ 2. _____

Structure Question

3. Some hot water at 90 °C is mixed with an equal mass of cold water at 40 °C. If no energy is gained from or lost to the surroundings, find the temperature. (3 marks)

4. A cold steel block is placed on top of a hot steel block at 80 °C. When they reach thermal equilibrium, their temperatures are 45 °C. If they have the same mass, find the initial temperature of the cold block. Assume no energy is gained from or lost to the surroundings. (3 marks)

5. When 200 g of hot water mixes with 150 g of cold water at 0 °C, the mixture has a temperature of 40 °C.

(a) How much energy is gained by the cold water? (3 marks)

(b) Estimate the initial temperature of the hot water. Assume no energy is gained from or lost to the surroundings.

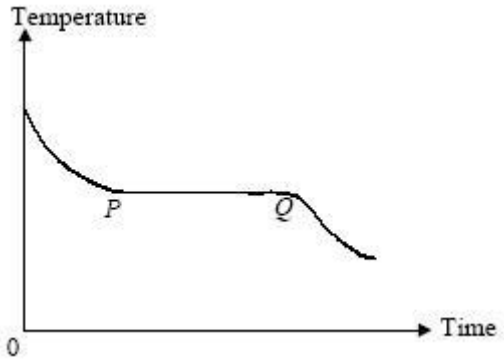
6. A girl has a mass of 50 kg and her body temperature is 37.1 °C. What will her body temperature be after drinking 300 g of tea at 10 °C? Assume her body and the tea she drank reach the same temperature instantly.

(Given: specific heat capacity of tea = 4200 J kg^{-1} $°C^{-1}$
Specific heat capacity of the girls body = 3500 J kg^{-1} $°C^{-1}$) (3 marks)

Topic 3.1: Latent heat

M.C. Section

1. The figure above shows the cooling curve of a substance which is initially in the liquid state. The temperature of the substance remains unchanged during the period *PQ*. Which of the following statements about the substance during the period *PQ* is/are correct?



(1) The substance is not losing any energy to the surroundings.
(2) Latent heat is absorbed by the substance.
(3) The average potential energy of the molecules of the substance is decreasing.

A. (1) only
B. (3) only
C. (1) and (2) only
D. (2) and (3) only

2. The melting point of copper is 1080°C and its specific latent heat of fusion is 2.1×10^5 J kg^{-1}. How much energy is needed to melt 0.5 kg of copper at its melting point ?

A. $\frac{2.1\times10^5}{0.5}$ J

B. $0.5 \times 2.1 \times 10^5$ J

C. $\frac{2.1 \times 10^5}{0.5 \times 1080}$ J

D. $0.5 \times 2.1 \times 10^5 \times 1080$ J

3. Which of the following substance is a liquid at room temperature (about 20°C)

	Substance	Melting point/°C	Boiling point/°C
A.	P	25	444
B.	Q	-39	357
C.	R	44	280
D.	S	-218	-183
E.	T	1083	2236

4. A cup of fruit juice is of mass 0.2 kg and temperature 70ºC. If the specific heat capacity of the fruit juice is 4000 J kg^{-1} K^{-1}, find the minimum amount of ice at 0ºC that should be added to the juice in order to lower its temperature to 0ºC.
(Note: Specific latent heat of fusion of ice = 3.34 x 10^5 J kg^{-1})

A. 0.17 kg
B. 0.20 kg
C. 0.37 kg
D. 0.84 kg

1. _____ 2. _____ 3. _____ 4. _____

Structure Question

5. When an ice block at 0°C is place at room temperature, the ice block first melts completely and then is heated up to 20°C. Describe the change in the motion of ice/water molecules and their potential and kinetic energies in the following states.
(a) The ice block is changing into water at 0 °C. (2 marks)

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(b) The water at 0 °C is heated up to 20 °C. (2 marks)

6. Given: Specific latent heat of vaporization of water: 2.26×10^6 J kg^{-1}
Jessie heats up 500 g of water from 20 °C with a constant power. The water starts to boil after 3 minutes.

(a) How long will it take for all the water to vaporize after it starts boiling? Give your answer correct to the nearest minute. Assume energy gained from or loss to surroundings can be neglected. (3 marks)

(b) Sketch how the mass of water changes with time on the graph provided. (4 marks)

