

AQA, Edexcel, OCR

A Level

A Level Physics

Thermal Physics

Name:

M M E

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Total Marks: /30

1.

Total for Question 1: 6

(a) Define thermal equilibrium.

[2]

(b) Why would a standard liquid-in-glass thermometer inserted into a mug of tea give an inaccurate insight into the initial temperature of the tea, even when thermal equilibrium has been reached? Is the reading randomly inaccurate, or is it systematically an over- or under-estimate?

[2]

(c) What transfer of heat, if any, happens when an 85°C metal rod is inserted into a 363 K vat of water?

[2]

2. The nature of solids, liquids and gases, and how they change with temperature, is best described by the kinetic theory, which states that all substances are a collection of atoms and molecules, each with a particular kinetic energy.

Total for Question 2: 12

- (a) Compare and contrast the spacing, ordering and motion of atoms in solids and liquids. [2]

- (b) Explain, in the context of the kinetic model, why solid-liquid-gas transitions might occur. [3]

- (c) Outline a simple experiment that could be performed to demonstrate the key principles of the kinetic model - that matter is made up of atoms and molecules and that they have kinetic energy. [2]

(d) Define the internal energy of a substance. [1]

(e) Why is the electrostatic energy of a liquid or solid conventionally assigned a negative value? [1]

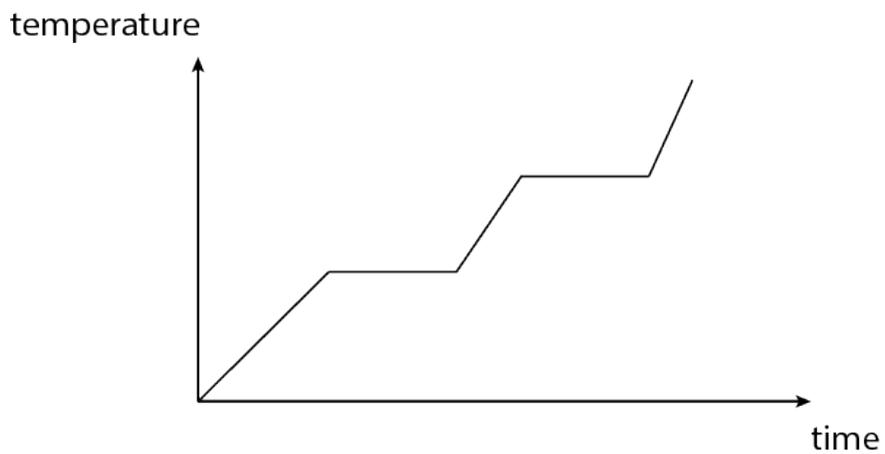
(f) State two ways in which a substance's internal energy can be increased. [2]

(g) Which of the following is correct? [1]

- i. At absolute zero the internal energy of a substance is zero.
- ii. At absolute zero the internal energy of a substance is negative.
- iii. At absolute zero the internal energy of a substance is positive.

3. The graph below shows the variation in temperature with time as a solid is heated using a hair dryer. The power of the hair dryer remains constant.

Total for Question 3: 12



- (a) Label the graph to show the following: the phase of the substance and its melting and boiling points. [2]

- (b) Why are the transitions not instantaneous? [2]

- (c) The freezing point of peanut oil varies, but is approximately 3°C . Its specific heat capacities above and below freezing are 2.40 and $2.65 \text{ kJkg}^{-1}\text{K}^{-1}$, respectively, and its latent heat of fusion is 60kJkg^{-1} . How long would it take for the 1000 W hairdryer to change 1 kg of the oil from a solid at 233 K to a liquid at 40°C ? [4]

- (d) Outline two methods that could be used to determine the specific heat capacity of a substance. [4]