IB PHYSICS

Name: ___________________________________

Period: ________ Date: ___________________

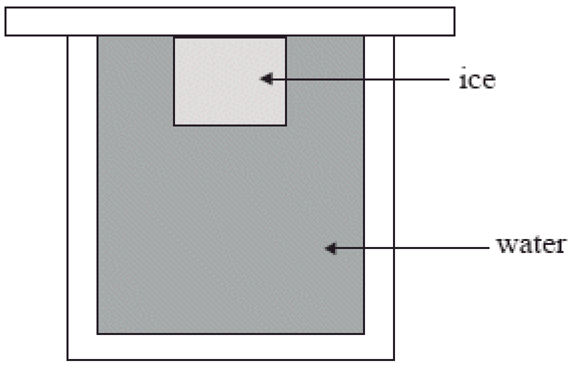
Marks: **52** Raw Score: ____ IB Curve: ____

DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

CHAPTER 3 TEST REVIEW

1. Water at a temperature of 0 °C is kept in a thermally insulated container. A lump of ice, also at 0 °C, is placed in the water and completely submerged.



Which of the following is true in respect of both the net amount of ice that will melt and the change in temperature of the water?

	Net amount of ice that melts	Change in temperature of water
A.	all will melt	no change
B.	some will melt	decrease
C.	none will melt	no change
D.	all will melt	decrease

(Total 1 mark)

2. Which of the following is an assumption made in the kinetic model of ideal gases?

A. Molecules have zero mass.

B. Forces between molecules are attractive.

C. Collisions between molecules are elastic.

D. Molecules move at high speed.

(Total 1 mark)

3. For two objects to be in thermal equilibrium they must

A. be in contact with each other.

B. radiate equal amounts of power.

C. have the same thermal capacity.

D. be at the same temperature.

(Total 1 mark)

4. A temperature of 23 K is equivalent to a temperature of

A. –300 °C.

B. –250 °C.

C. +250 °C.

D. +300 °C.

(Total 1 mark)

5. 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 J kg^{-1} K^{-1} is calculated from which of the following?

A. $\frac{60 \times 100}{0.1 \times 40}$

B. $\frac{60 \times 0.1}{40}$

C. $\frac{0.1 \times 40}{60}$

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

(Total 1 mark)

6. 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.

(Total 1 mark)

7. 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 J kg^{-1} K^{-1}.

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

D. has unit kg.

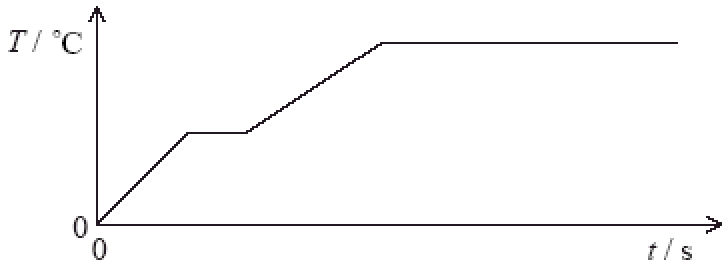
(Total 1 mark)

8. An ice cube and an iceberg are both at a temperature of 0 °C. Which of the following is a correct comparison of the average random kinetic energy and the total kinetic energy of the molecules of the ice cube and the iceberg?

	Average random kinetic energy	**Total kinetic energy**
A.	same	same
B.	same	different
C.	different	same
D.	different	different

(Total 1 mark)

9. Thermal energy is added at a constant rate to a substance which is solid at time $t = 0$. The graph shows the variation with t of the temperature T.



Which of the statements are correct?

I. The specific latent heat of fusion is greater than the specific latent heat of vaporization.

II. The specific heat capacity of the solid is less than the specific heat capacity of the liquid.

A. I only

B. I and II

C. II only

D. Neither I nor II

(Total 1 mark)

10. The temperature of an ideal gas is a measure of the molecules' average

A. velocity.

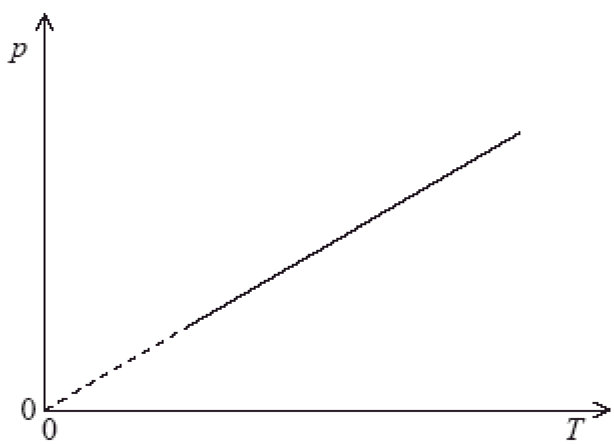
B. momentum.

C. kinetic energy.

D. frequency of collisions.

(Total 1 mark)

11. The graph shows the variation with absolute temperature T of the pressure p of a fixed mass of an ideal gas.



Which of the following is correct concerning the volume and the density of the gas?

	Volume	Density
A.	constant	constant
B.	constant	increasing
C.	increasing	constant
D.	increasing	increasing

(Total 1 mark)

12. An ideal gas has pressure p_0 and volume V_0. The number of molecules of the gas is doubled without changing the temperature. What is the new value of pressure times volume?

A. $\frac{p_0 V_0}{4}$

B. $\frac{p_0 V_0}{2}$

C. $p_0 V_0$

D. $2p_0 V_0$

(Total 1 mark)

13. This question is about heating a liquid.

(a) Suggest why, in terms of the molecular model, the energy associated with melting is less than that associated with boiling.

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(2)

(b) Milk in a cup is heated to boiling point by passing steam through it. Whilst cooling subsequently, some milk evaporates.

(i) Distinguish between evaporation and boiling.

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(2)

(ii) The cup contains 0.30 kg of milk at an initial temperature of 18 °C. Estimate the minimum mass of steam at 100 °C that is required to heat the milk to 80 °C.

Specific latent heat of vaporization of water = 2.3×10^6 J kg^{-1}
Specific heat capacity of water = 4200 J kg^{-1} K^{-1}
Specific heat capacity of milk = 3800 J kg^{-1} K^{-1}

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(4)

(iii) State **two** reasons, other than evaporation, why the answer to (b)(ii) is likely to be different from the actual mass of condensed steam.

1: ....

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2: ....

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(2)

14. This question is about internal energy, heat and ideal gases.

(a) The internal energy of a piece of copper is increased by heating.

(i) Explain what is meant, in this context, by internal energy and heating.

Internal energy: ....

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Heating: ....

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(3)

(ii) The piece of copper has mass 0.25 kg. The increase in internal energy of the copper is 1.2×10^3 J and its increase in temperature is 20 K. Estimate the specific heat capacity of copper.

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(2)

(b) One mole of an ideal gas is heated at constant pressure. The increase in temperature of the gas is 30.0 K. The energy transferred to the gas is 623 J and the work done is 249 J.

Determine

(i) the change in internal energy of the gas.

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(3)

(ii) the thermal capacity of the gas.

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(2)

(c) Another mole of the same gas is heated at constant volume starting from the same state as that in (b). Suggest whether the thermal capacity in this case is equal to, greater than **or** less than the answer in b(ii).

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(3)

15. This question is about fuel for heating.

(a) Define the *energy density* of a fuel.

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(1)

(b) A room heater burns liquid fuel and the following data are available.

Density of liquid fuel	$= 8.0 \times 10^{2}$ kg m^{-3}
Energy produced by 1 m^3 of liquid fuel	$= 2.7 \times 10^{10}$ J
Rate at which fuel is consumed	$= 0.13$ g s^{-1}
Latent heat of vaporization of the fuel	$= 290$ kJ kg^{-1}

(i) Use the data to calculate the power output of the room heater, ignoring the power required to convert the liquid fuel into a gas.

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(3)

(ii) Show why, in your calculation in (b)(i), the power required to convert the liquid fuel into a gas at its boiling point can be ignored.

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(2)

(c) State, in terms of molecular structure and their motion, **two** differences between a liquid and a gas.

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2. ....

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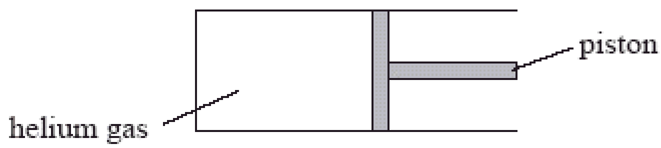
(2)

16. This question is about changes of state of a gas.

(a) A cylinder fitted with a piston contains 0.23 mol of helium gas.



The following data are available for the helium with the piston in the position shown.

Volume $= 5.2 \times 10^{-3}\ m^3$
Pressure $= 1.0 \times 10^5$ Pa
Temperature = 290 K

(i) Use the data to calculate a value for the universal gas constant.

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(2)

(ii) State the assumption made in the calculation in (a)(i).

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(1)

(b) The gas is now compressed isothermally by the piston so that the volume of the gas is reduced. Explain why the compression must be carried out slowly.

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(2)

(c) After the compression, the gas is now allowed to expand adiabatically to its original volume. Use the first law of thermodynamics to explain whether the final temperature will be less than, equal to or greater than 290 K.

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(4)