

1. A solid piece of tungsten melts into liquid without a change in temperature. Which of the following is correct for the molecules in the liquid phase compared with the molecules in the solid phase?

	Kinetic energy	Potential energy
A.	same	greater
B.	same	same
C.	greater	greater
D.	greater	same

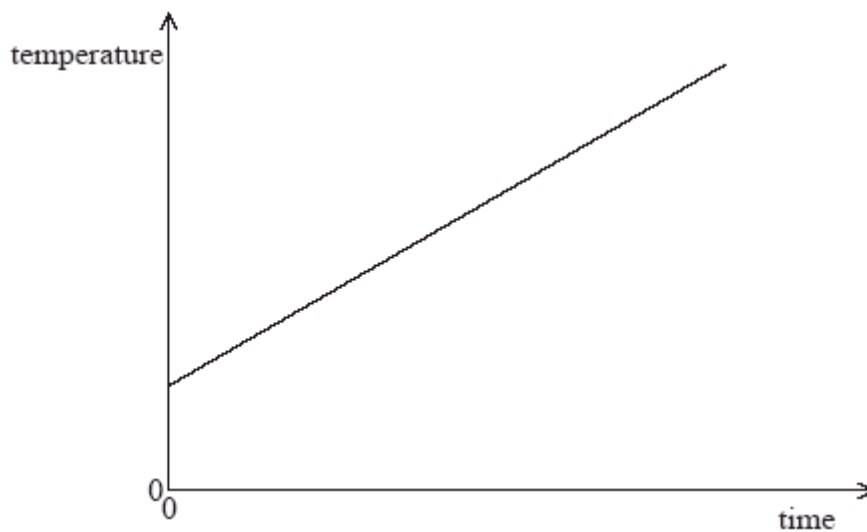
(Total 1 mark)

2. What is the mass of carbon-12 that contains the same number of atoms as 14 g of silicon-28?

- A. 6 g
- B. 12 g
- C. 14 g
- D. 24 g

(Total 1 mark)

3. A heater of constant power heats a liquid of mass m and specific heat capacity c . The graph below shows how the temperature of the liquid varies with time.



The gradient of the graph is k and no energy is lost to the surroundings. What is the power of the heater?

- A. kmc
- B. $\frac{k}{mc}$
- C. $\frac{mc}{k}$
- D. $\frac{1}{kmc}$

(Total 1 mark)

4. The energy of the molecules of an ideal gas is

- A. thermal only.
- B. thermal and potential.
- C. potential and kinetic.
- D. kinetic only.

(Total 1 mark)

5. Oil with volume V has specific heat capacity c at temperature T . The density of oil is ρ .

Which of the following is the thermal capacity of the oil?

- A. ρcV
- B. $\frac{cV}{\rho}$
- C. ρcVT
- D. $\frac{cV}{\rho T}$

(Total 1 mark)

6. The volume of an ideal gas in a container is increased at constant temperature. Which of the following statements is/are correct about the molecules of the gas?

- I. Their speed remains constant.
- II. The frequency of collisions of molecules with unit area of the container wall decreases.
- III. The force between them decreases.

- A. I only
- B. I and II only
- C. I and III only
- D. II and III only

(Total 1 mark)

7. Two objects are in thermal contact with each other. Which of the following will determine the direction of the transfer of thermal energy between the bodies?

- A. The mass of each body
- B. The area of contact between the bodies
- C. The specific heat capacity of each body
- D. The temperature of each body

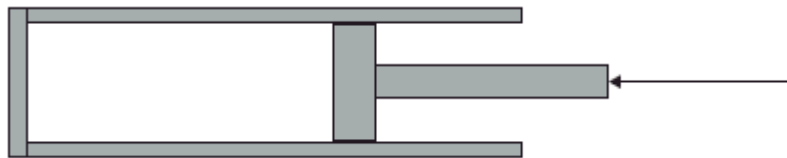
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8. The mole is defined as

- A. $\frac{1}{12}$ the mass of an atom of the isotope carbon-12.
- B. the amount of a substance that contains as many elementary entities as the number of atoms in 12 g of the isotope carbon-12.
- C. the mass of one atom of the isotope carbon-12.
- D. the amount of a substance that contains as many nuclei as the number of nuclei in 12 g of the isotope carbon-12.

(Total 1 mark)

9. A gas is contained in a cylinder by a piston.

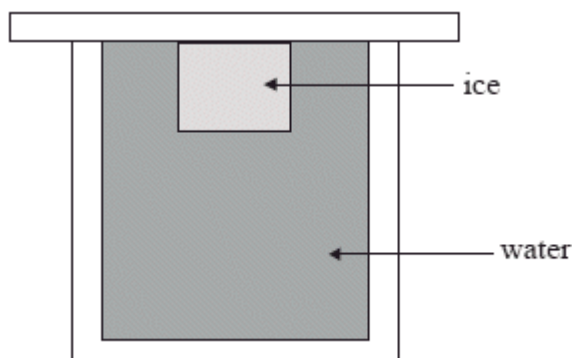


The gas is compressed rapidly by moving the piston in the direction shown. The best explanation for the resulting increase in temperature of the gas is that the molecules of the gas gain kinetic energy

- A. from the moving piston.
- B. by colliding more frequently with each other.
- C. by being pushed closer together.
- D. by colliding more frequently with the walls of the cylinder.

(Total 1 mark)

10. Water at a temperature of $0\text{ }^{\circ}\text{C}$ is kept in a thermally insulated container. A lump of ice, also at $0\text{ }^{\circ}\text{C}$, 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)

11. A box that is at rest with respect to horizontal ground contains a fixed quantity of an ideal gas. The internal energy of the gas is U and its temperature is T . The box is now made to move at constant speed with respect to the ground. Which of the following gives the change, if any, in the internal energy and the temperature of the gas after the box has been moving for some time?

	Internal energy	Temperature
A.	no change	no change
B.	no change	increase
C.	increase	no change
D.	increase	increase

(Total 1 mark)

12. Object P has a mass m_P and specific heat capacity c_P . Object Q has a mass m_Q and specific heat capacity c_Q . The temperature of each object increases by the same amount. Which of the following gives the ratio

$$\frac{\text{thermal energy transferred to object P}}{\text{thermal energy transferred to object Q}} ?$$

- A. $\frac{m_P c_Q}{m_Q c_P}$
- B. $\frac{m_P c_P}{m_Q c_Q}$
- C. $\frac{m_Q c_Q}{m_P c_P}$
- D. $\frac{m_Q c_P}{m_P c_Q}$

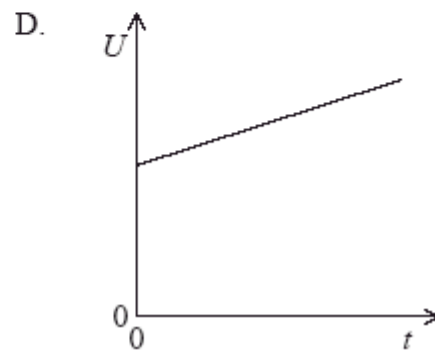
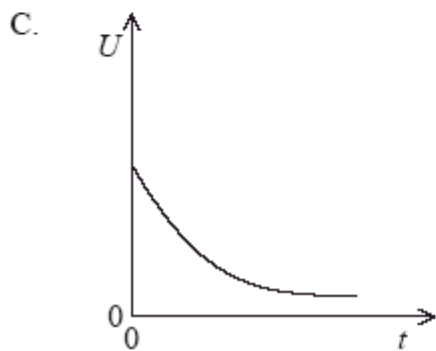
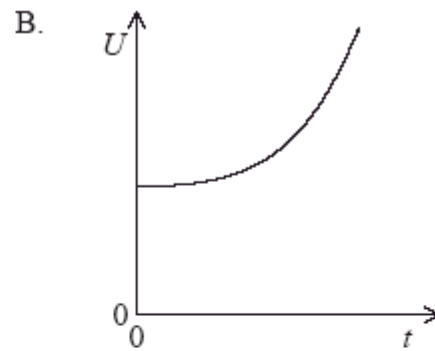
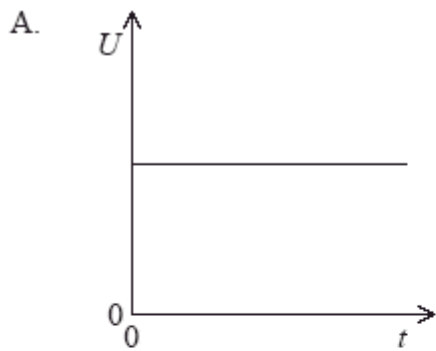
(Total 1 mark)

13. 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.

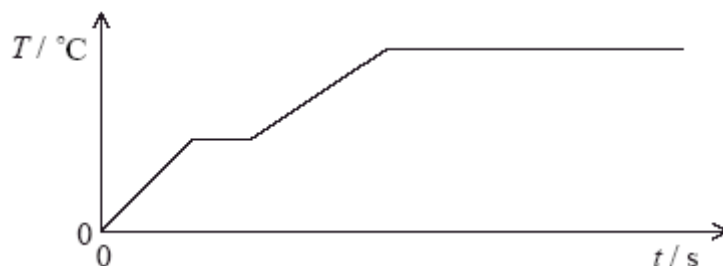
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14. A system consists of an ice cube placed in a cup of water. The system is thermally insulated from its surroundings. The water is originally at $20\text{ }^{\circ}\text{C}$. Which graph best shows the variation of total internal energy U of the system with time t ?



(Total 1 mark)

15. 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)

16. 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)

17. An ice cube and an iceberg are both at a temperature of $0\text{ }^{\circ}\text{C}$. 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)

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

- A. $-300\text{ }^{\circ}\text{C}$.
- B. $-250\text{ }^{\circ}\text{C}$.
- C. $+250\text{ }^{\circ}\text{C}$.
- D. $+300\text{ }^{\circ}\text{C}$.

(Total 1 mark)

19. 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 .

(Total 1 mark)

20. 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.

(Total 1 mark)

21. Two objects near each other are at the same temperature. Which of the following statements has to be true?
- A. The objects have the same internal energy.
 - B. The objects have the same thermal capacity.
 - C. No thermal energy is exchanged between the objects.
 - D. The net thermal energy exchanged between the objects is zero.

(Total 1 mark)

22. 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)

23. 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)

24. 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

(Total 1 mark)

25. 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)

26. 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 $\text{J kg}^{-1} \text{K}^{-1}$ 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. $\frac{60}{40}$

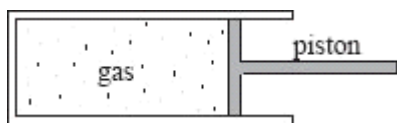
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27. The internal energy of a solid substance is equal to the

- A. average kinetic energy of the molecules.
- B. total kinetic energy of the molecules.
- C. total potential energy of the molecules.
- D. total potential and total kinetic energy of the molecules.

(Total 1 mark)

28. A gas is contained in a cylinder fitted with a piston as shown below.

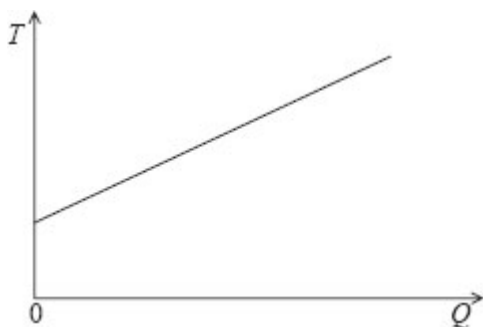


When the gas is compressed rapidly by the piston its temperature rises **because** the molecules of the gas

- A. are squeezed closer together.
- B. collide with each other more frequently.
- C. collide with the walls of the container more frequently.
- D. gain energy from the moving piston.

(Total 1 mark)

29. The specific heat capacity c of a solid block of mass m is determined by heating the block and measuring its temperature. The graph below shows the variation of the temperature T of the block with the thermal energy Q transferred to the block.



The gradient of the line is equal to

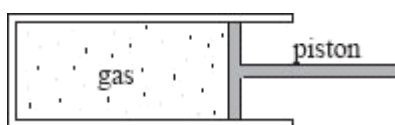
- A. $\frac{c}{m}$.
- B. $\frac{m}{c}$.
- C. mc .
- D. $\frac{1}{mc}$.

(Total 1 mark)

30. The internal energy of a solid substance is equal to the
- A. average kinetic energy of the molecules.
 - B. total kinetic energy of the molecules.
 - C. total potential energy of the molecules.
 - D. total potential and total kinetic energy of the molecules.

(Total 1 mark)

31. A gas is contained in a cylinder fitted with a piston as shown below.



When the gas is compressed rapidly by the piston its temperature rises **because** the molecules of the gas

- A. are squeezed closer together.
- B. collide with each other more frequently.
- C. collide with the walls of the container more frequently.
- D. gain energy from the moving piston.

(Total 1 mark)