3.21 Particle Motion, Gas Pressure and Temperature: Test Pack

Total Marks

AQA 8464 · Calculator allowed · about 20 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Describe the motion of the particles in a gas.

.....

.....

(Total for Question 1 is 2 marks)

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2 Convert the following temperatures to kelvin. Use: temperature in kelvin (K) = temperature in degrees Celsius (°C) + 273

(a) 27°C **(1)**

.....

(b) -18°C **(1)**

.....

(c) 100°C **(1)**

.....

(Total for Question 2 is 3 marks)

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3 State what is meant by 'absolute zero', and give its value in degrees Celsius.

(Total for Question 3 is 2 marks)

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4 Use the particle model to explain why a gas exerts a pressure on the walls of its container.

(Total for Question 4 is 3 marks)

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5 Ffion uses a hand pump to inflate a bicycle tyre. The piston of the pump exerts an average force of 45 N on the trapped air as it moves a distance of 0.12 m into the pump barrel.

(a) Calculate the work done on the gas as the piston moves through this distance. **(2)**
Use: work done = force x distance moved in the direction of the force (W = F x d).

(b) State which energy store of the gas increases as a result of this work being done on it. **(1)**

(Total for Question 5 is 3 marks)

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6 Ffion also notices that the pump barrel only becomes slightly warm if she inflates the same tyre slowly, using the same total number of pump strokes. Explain this difference.

(Total for Question 6 is 3 marks)

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Mark scheme · 3.21 Particle Motion, Gas Pressure and Temperature: Test Pack

Question 1

particles move randomly, in random directions, oe **B1**

particles move in straight lines at constant speed between collisions; collisions can change their speed and direction, oe **B1**

Answer: Gas particles move randomly, travelling in straight lines at constant speed between collisions. Collisions with other particles or the container walls can change their speed and direction.

Question 2

(a) 300 K cao **B1**

(a) Answer: 300 K

(b) 255 K cao **B1**

(b) Answer: 255 K

(c) 373 K cao **B1**

(c) Answer: 373 K

Question 3

the (theoretical) minimum possible temperature, at which particles have the minimum possible kinetic energy, oe **B1**

-273°C (accept 0 K) cao **B1**

Answer: Absolute zero is the lowest possible temperature, at which particles have minimum kinetic energy. It is equal to -273°C (0 K).

Question 4

the gas particles move randomly and continuously, colliding with the walls of the container, oe **B1**

each collision exerts a (tiny) force on the wall, acting at right angles (normal) to the surface, oe **B1**

the total force from the very large number of collisions, acting over the surface area of the walls, causes the pressure of the gas, oe **B1**

Answer: Gas particles move randomly and collide with the container walls; each collision exerts a force at right angles to the surface, and the total force per unit area from many collisions causes the gas pressure.

Question 5

(a) correct substitution: W = 45 * 0.12, oe **M1**

(a) 5.4 J cao **A1**

(a) Answer: 5.4 J

(b) the internal energy (store) of the gas, oe (accept thermal energy store) **B1**

(b) Answer: The internal energy store of the gas.

Question 6

the same total amount of work is done on the gas whether pumping quickly or slowly, so the same total energy is transferred to the gas overall, oe **B1**

pumping quickly transfers this energy in a shorter time, so the rate of energy transfer (power) is much greater, causing a bigger rise in temperature, oe **B1**

pumping slowly gives more time for the transferred energy to be transferred away to the surroundings (e.g. through the metal barrel) as it is produced, so the temperature rise is smaller/less noticeable, oe **B1**

Answer: The same total work is done either way, but pumping quickly transfers it in less time (higher power), causing a bigger temperature rise; pumping slowly allows more time for energy to spread to the surroundings.

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