Section A

1. This question is about gas pressure.
   a. Which is the correct description of how particles move in a gas?
   Tick (✓) **one** box.

   At random speeds in the same direction ☐

   At random speeds in random directions ☐

   At the same speed in the same direction ☐

   At the same speed in random directions ☐

   b. Gas pressure is exerted when particles collide with a surface of a container.
   Explain what this means.

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   c. What is the relationship between gas pressure and temperature (when the volume of the gas stays the same)?
   Tick (✓) **one** box.

   They are directly proportional ☐

   They are indirectly proportional ☐

   They are inversely proportional ☐

   d. Which property of gas particles is the temperature related to?

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   e. What is the relationship between gas pressure and volume (when the temperature of the gas stays the same)?
   Tick (✓) **one** box.

   They are directly proportional ☐

   They are indirectly proportional ☐

   They are inversely proportional ☐

Section B

2. The image shows a syringe that contains air. The syringe is placed into an ice bath, which decreases the temperature of the air in the syringe.
   a. What would happen to the average kinetic energy of the particles when the temperature is decreased?

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   b. Explain why the average kinetic energy is used.

_____

_____

   c. What would happen to the average speed of the gas particles if the temperature decreased?

_____

   d. What would happen to the gas pressure inside the syringe if the temperature decreased?

_____

   e. The plunger of the syringe is pulled outwards. Why does air move into the syringe as the plunger is pulled outwards?

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_____

   f. The syringe is then placed into a hot water bath. Complete the table by ticking the correct box to identify what would happen to the following quantities.

	Increases	Decreases	Stays the same
Mass of the gas			
Density of the gas			
Average speed of particles of gas			
Pressure exerted by the gas			

3. The relationship between the pressure of a gas and its volume is given by the equation:

$$\text{Pressure} \times \text{volume} = \text{constant}$$

For this equation to apply, what two properties of the gas must stay the same?

1._____

2._____

4. Describe the effect of increasing the temperature on the pressure of a gas. Explain your answer.

_____

_____

_____

5. Describe the effect of increasing the volume on the pressure of a gas. Explain your answer.

_____

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6. Use the following equation to answer this question:

$$p_1 \times V_1 = p_2 \times V_2$$

a. A gas sample has a volume of 22 m^3 at a constant temperature.
What is the new volume if the pressure changes from:

i. 5 Pa to 10 Pa?
ii. 81 Pa to 124 Pa?

b. If the temperature remains constant, calculate the new pressure if a volume of gas of:

i. 1.5 m^3 at a pressure of 120 Pa changes to 0.5 m^3.
ii. 0.02 m^3 at a pressure of 72000 Pa changes to 0.6 m^3.

Section C

7. A group of scientists were investigating the behaviour of air particles at different temperatures. They used the same container throughout, which had a volume of 1 m^3. They cooled the air from 22 °C to 0 °C.
   a. Describe and explain what would happen to the particles of air in the container.
   b. Describe and explain what would happen to the pressure within the container.
   c. Is air an element, a compound or mixture? Explain your answer.
   d. Water within the air froze at 0 °C. The specific latent heat of fusion of water is 330 kJ/kg and the change in internal energy of the water was 0.85 kJ.
      Calculate the mass of ice that formed.
      Use the equation: $\Delta E = m L$
   e. The air also contains oxygen and nitrogen. The melting and boiling points of each substance is shown in the table.

	Melting point (°C)	Boiling point (°C)
Oxygen	-218	-183
Nitrogen	-210	-195

The apparatus the scientists were using allowed them to cool the air to -190 °C. What state would the water, the oxygen and the nitrogen be in at -190 °C?