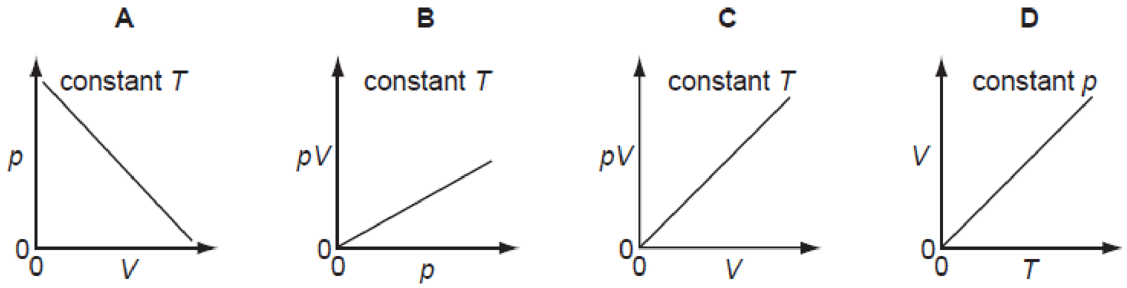
Section A

Q1 Which of the following least resembles an ideal gas?
A ammonia B helium C hydrogen D trichloromethane

Q2 The density of ice is 1.00 g cm^{-3}.
What is the volume of steam produced when 1.00 cm^3 of ice is heated to 323 °C (596 K) at a pressure of one atmosphere (101 kPa)?
[1 mol of a gas occupies 24.0 dm^3 at 25 °C (298 K) and one atmosphere.]
A 0.267 dm^3 B 1.33 dm^3 C 2.67 dm^3 D 48.0 dm^3

Q3 Which diagram correctly describes the behaviour of a fixed mass of an ideal gas? (T is measured in K.)



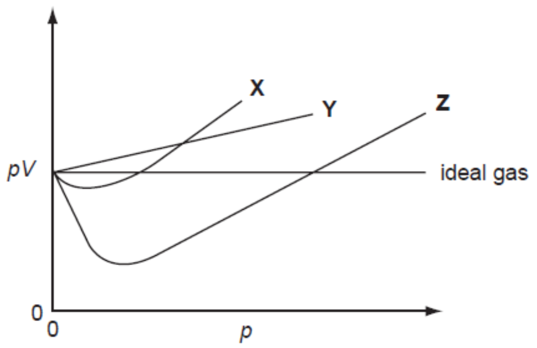
Q4 Use of the Data Booklet is relevant to this question.
The gas laws can be summarised in the ideal gas equation.

$$pV = nRT$$

0.96 g of oxygen gas is contained in a glass vessel of volume 7000 cm^3 at a temperature of 30 °C. What is the pressure in the vessel?
A 1.1 kPa B 2.1 kPa C 10.8 kPa D 21.6 kPa

Q5 Which gas is likely to deviate most from ideal gas behaviour?
A HCl B He C CH_4 D N_2

Q6 For an ideal gas, the plot of pV against p is a straight line. For a real gas, such a plot shows a deviation from ideal behaviour. The plots of pV against p for three real gases are shown below. The gases represented are ammonia, hydrogen and nitrogen.
What are the identities of the gases X, Y and Z?



	X	Y	Z
A	ammonia	nitrogen	hydrogen
B	hydrogen	nitrogen	ammonia
C	nitrogen	ammonia	hydrogen
D	nitrogen	hydrogen	ammonia

Q7 Which of the following would behave most like an ideal gas at room temperature?
A carbon dioxide B helium C hydrogen D nitrogen

Q8 Flask X contains 5 dm^3 of helium at 12 kPa pressure and flask Y contains 10 dm^3 of neon at 6 kPa pressure.
If the flasks are connected at constant temperature, what is the final pressure?
A 8 kPa B 9 kPa C 10 kPa D 11 kPa

Q9 Use of the Data Booklet is relevant to this question.
The volume of a sample of ammonia is measured at a temperature of 60 °C and a pressure of 103 kPa. The volume measured is 5.37×10^{-3} m^3.
What is the mass of the sample of ammonia, given to two significant figures?
A 0.00019 g B 0.0034 g C 0.19 g D 3.4 g

Section B

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

Q10 An ideal gas obeys the gas laws under all conditions of temperature and pressure.
Which of the following are true for an ideal gas?
1 The molecules have negligible volume.
2 There are no forces of attraction between molecules.
3 The molecules have an average kinetic energy which is proportional to its absolute temperature.

Q11 When a sample of a gas is compressed at constant temperature from 1500 kPa to 6000 kPa, its volume changes from 76.0 cm^3 to 20.5 cm^3.
Which statements are possible explanations for this behaviour?
1 The gas behaves non-ideally.
2 The gas partially liquefies.
3 Gas is adsorbed on to the vessel walls.

Q12 Which equations apply to an ideal gas?
[p = pressure, V = volume, M = molar mass, ρ = density, c = concentration, R = gas constant, T = temperature]

1 $p = \frac{\rho RT}{M}$ **2** $pV = MRT$ **3** $pV = \frac{cRT}{M}$

Q13 What are assumptions of the kinetic theory of gases and hence of the ideal gas equation, PV = nRT ?
1 Molecules move without interacting with one another except for collisions.
2 Intermolecular forces are negligible.
3 Intermolecular distances are much greater than the molecular size.

1. A
2. C
3. D
4. C
5. A
6. D
7. B
8. A
9. D
10. A
11. D
12. D
13. A

Q1 When used for cutting or welding, ethyne is transported in cylinders which contain the gas under pressure. A typical cylinder has a volume of 76 dm^3 and contains ethyne gas at 1515 kPa pressure at a temperature of 25 °C. Use the general gas equation, $pV = nRT$, to calculate the amount, in moles, of ethyne in this cylinder.

(June 2006)

Q2 **(a)** At sea level and a temperature of 20 °C an inflated bicycle tyre contains 710 cm^3 of air at an internal pressure of 6×10^5 Pa. Use the general gas equation $PV = nRT$ to calculate the amount, in moles, of air in the tyre at sea level.

(b) The same bicycle, with its tyres inflated at sea level as described in **(a)** above, is placed in the luggage hold of an airliner. At a height of 10 000 m, the temperature in the luggage hold is 5 °C and the air pressure is 2.8×10^4 Pa.

(June 2011 P21)

Q3 The kinetic theory of gases is used to explain the large scale (macroscopic) properties of gases by considering how individual molecules behave.

(a) State **two** basic assumptions of the kinetic theory as applied to an ideal gas.

(i)..

....

(ii)..

....

(b) State **two** conditions under which the behaviour of a real gas approaches that of an ideal gas.

(i)..

(ii)..

(c) Place the following gases in decreasing order of ideal behaviour.

ammonia, neon, nitrogen

most ideal .... **least ideal**
Explain your answer.

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(d) By using the kinetic-molecular model, explain why a liquid eventually becomes a gas as the temperature is increased.

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(June 2011 P23)

Q4 CO_2 does not behave as an ideal gas.

(a) State all the basic assumptions of the kinetic theory as applied to an ideal gas.

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(b) Suggest **one** reason why CO_2 does not behave as an ideal gas.

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(Nov 2009 P22)