

- 7 In this question it should be assumed that nitrogen behaves as an ideal gas under the conditions stated.

Which volume is occupied by 1.00 g of nitrogen at 50.0 °C and at a pressure of 120 kPa?

- A 0.124 dm³ B 0.799 dm³ C 1.60 dm³ D 22.4 dm³

- 7 Sodium azide, NaN₃, decomposes as shown.



Which volume of nitrogen, measured at room temperature and pressure, will be produced by the decomposition of 150 g of sodium azide?

- A 166 dm³ B 83 dm³ C 55 dm³ D 37 dm³

- 8 In an experiment, 0.100 mol of propan-1-ol is burnt completely in 12.0 dm³ of oxygen, measured at room conditions.

What is the final volume of gas, measured at room conditions?

- A 7.20 dm³ B 8.40 dm³ C 16.80 dm³ D 18.00 dm³

- 8 When an evacuated glass bulb of volume 200 cm³ is filled with a gas at 300 K and 101 kPa, the mass of the bulb increases by 0.68 g. The gas obeys the ideal gas equation.

What is the identity of the gas?

- A argon
B krypton
C neon
D nitrogen

- 4 A 3.7 g sample of copper(II) carbonate is added to 25 cm³ of 2.0 mol dm⁻³ hydrochloric acid.

Which volume of gas is produced at room conditions?

- A 0.60 dm³ B 0.72 dm³ C 1.20 dm³ D 2.40 dm³

- 2 How many molecules are present in 62 g of solid white phosphorus, P₄?

- A L B $2L$ C $\frac{L}{2}$ D $\frac{L}{4}$

- 3 Which sample contains the most iodine?

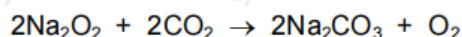
- A 1 g of CaI₂ B 1 g of KI C 1 g of NaI D 1 g of NH₄I

- 8 The general gas equation can be used to calculate the value of the M_r of a gas.

For a sample of a gas of mass m grams, which expression will give the value of M_r ?

- A $M_r = \frac{mRT}{pV}$ B $M_r = \frac{pVRT}{m}$ C $M_r = \frac{mpV}{RT}$ D $M_r = \frac{pV}{mRT}$

- 2 Sodium peroxide, Na_2O_2 , is used to absorb carbon dioxide from the atmosphere and release oxygen in closed environments such as space capsules and submarines.



Which mass of sodium peroxide would be required to remove 2.4 dm^3 of carbon dioxide from the atmosphere at room temperature and pressure?

- A 2.4 g B 3.9 g C 7.8 g D 15.6 g

- 2 Which statement is correct?

- A 1.0 g of hydrogen gas contains 3.0×10^{23} atoms.
B 4.0 g of helium gas contains 1.2×10^{24} atoms.
C 16 g of methane gas contains 3.0×10^{24} atoms.
D 44 g of carbon dioxide gas contains 6.0×10^{23} atoms.

- 5 Flask Q contains 5 dm^3 of helium at 12 kPa pressure. Flask R 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

- 3 A 0.216 g sample of aluminium carbide reacts with an excess of water to produce methane gas. This is the only carbon-containing product formed in the reaction. This methane gas burns completely in O_2 to form H_2O and CO_2 only. The volume of CO_2 produced at room temperature and pressure is 108 cm^3 .

What is the formula of aluminium carbide?

- A Al_2C_3 B Al_3C_2 C Al_3C_4 D Al_4C_3

- 2 A copper ore contains 3.00% of copper carbonate, CuCO_3 , by mass.

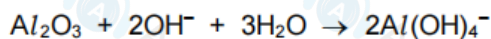
Which mass of copper would be obtained from 1 tonne of the ore?

- A 1.91 kg B 3.71 kg C 15.4 kg D 58.4 kg

- 5 A white powder is known to be a mixture of magnesium oxide and aluminium oxide.

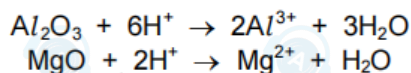
100 cm³ of 2 mol dm⁻³ NaOH(aq) is just enough to dissolve the aluminium oxide in x grams of the mixture.

The reaction is shown.



800 cm³ of 2 mol dm⁻³ HCl(aq) is just enough to dissolve **all** of the oxide in x grams of the mixture.

The reactions are shown.



How many moles of each oxide are present in x grams of the mixture?

| | aluminium oxide | magnesium oxide |
|---|-----------------|-----------------|
| A | 0.05 | 0.25 |
| B | 0.05 | 0.50 |
| C | 0.10 | 0.25 |
| D | 0.10 | 0.50 |

- 14 Which statement about atoms and molecules is correct?

- A The molecular formula of a compound is the simplest whole number ratio of atoms of each element in the compound.
- B One mole of any substance contains 6×10^{23} atoms.
- C The relative atomic mass of an element is the ratio of the average mass of one atom of the element to the mass of an atom of carbon-12.
- D The relative formula mass of a compound is the sum of the individual atomic masses of all the atoms in the formula.

- 31 A sample of 2.30 g of ethanol is mixed with an excess of aqueous acidified potassium dichromate(VI). The reaction mixture is boiled under reflux for one hour. The required organic product is then collected by distillation. The yield of product is 60.0%.

Which mass of product is collected?

- A 1.32g B 1.38g C 1.80g D 3.00g

- 9 At a temperature of 2500 K and a pressure of 1.00×10^{-4} Pa, a sample of 0.321 g of sulfur vapour has a volume of 2.08×10^6 m³.

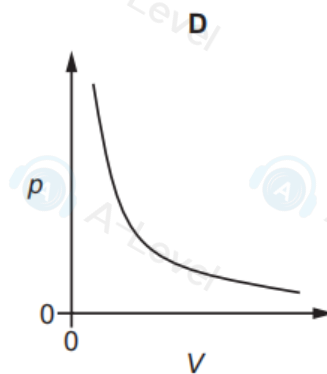
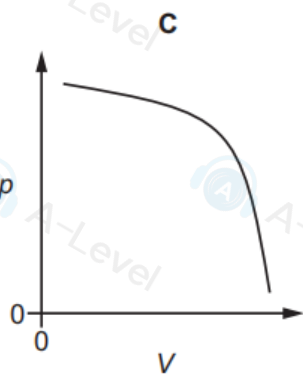
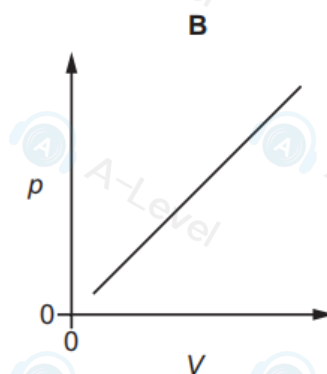
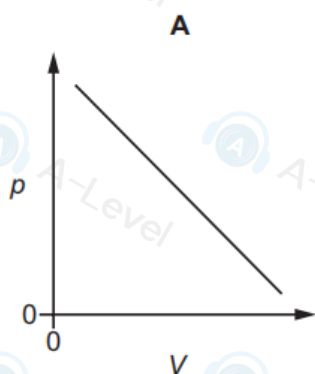
What is the molecular formula of sulfur under these conditions?

- A S B S₂ C S₄ D S₈

- 4 What is the maximum volume of sulfur dioxide gas measured at room conditions produced from burning 100 dm³ of diesel fuel containing 0.8346 g of sulfur?

- A 291 cm³ B 312 cm³ C 582 cm³ D 624 cm³

- 15 Which graph represents the variation of pressure p and volume V of a sample of an ideal gas at constant temperature?



- 7 A weather balloon is filled with 12.0 kg helium. The weather balloon reaches a height of 20 km, the pressure inside the balloon is 6000 Pa and the temperature is 216 K.

What is the volume of the weather balloon at this height, correct to three significant figures?

- A 897 dm³ B 1790 dm³ C 897 000 dm³ D 1 790 000 dm³

- 7 Which gas will behave **least** like an ideal gas at 150 °C and 101 kPa?

- A ammonia
B fluorine
C krypton
D steam

- 1 Compound X consists of 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass.

What is the empirical formula of compound X?

- A CH₂O B C₂H₂O C C₂H₄O D CHO

- 6 A solution contains 0.25 g of sulfur dioxide in 1.00 dm³ of water.

Which volume of sulfur dioxide, measured at 50 °C and a pressure of 1×10^5 Pa, must be added to 1.00 dm³ of water to produce this solution?

- A 0.0162 cm³ B 0.105 cm³ C 16.2 cm³ D 105 cm³

- 9 The complete combustion of 2 moles of an alkane produces 400 dm^3 of carbon dioxide measured at 301 K and $1 \times 10^5 \text{ Pa}$. Carbon dioxide can be assumed to behave as an ideal gas under these conditions.

What is the formula of the alkane?

- A C_8H_{18} B $\text{C}_{16}\text{H}_{34}$ C $\text{C}_{20}\text{H}_{42}$ D $\text{C}_{40}\text{H}_{82}$

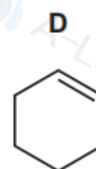
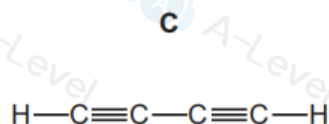
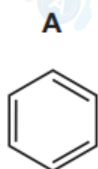
- 7 In this question you may assume that nitrogen behaves as an ideal gas. One atmosphere pressure = 101 kPa .

Which volume does 1.0 g of nitrogen occupy at 50°C and a pressure of 2.0 atmospheres?

- A 70 cm^3 B 150 cm^3 C 470 cm^3 D 950 cm^3

- 4 When a small sample of hydrocarbon Q is completely combusted, it produces 3.52 g of carbon dioxide and 1.44 g of water.

What could be the structure of hydrocarbon Q?



- 3 Substance Q is a hydrocarbon. When 1.00 g of Q is completely burned, 3.22 g of carbon dioxide is produced.

What could be the identity of Q?

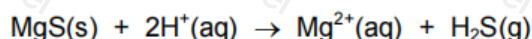
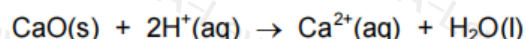
- A cyclohexene
B cyclopentane
C ethene
D pentane

- 8 The volume of a vessel is $1.20 \times 10^{-3} \text{ m}^3$. It contains pure argon at a pressure of $1.00 \times 10^5 \text{ Pa}$, and at a temperature of 25.0°C . Under these conditions it can be assumed that argon behaves as an ideal gas.

Which mass of argon does it contain?

- A 0.0485 g B 1.93 g C 10.4 g D 23.0 g

- 4 Calcium oxide and magnesium sulfide each react with acid.



A mixture of these two compounds, X, reacts with exactly 0.125 mol of dilute hydrochloric acid.

The amount of hydrogen sulfide formed is 0.0250 mol .

What was the mass of calcium oxide in mixture X?

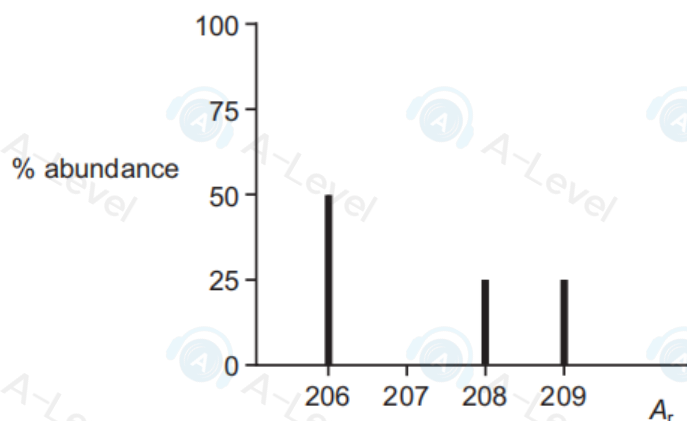
- A 1.4 g B 2.1 g C 2.8 g D 4.2 g

14 Each of the substances shown is gaseous.

Which substance is most likely to show ideal behaviour in the conditions shown?

| | substance | temperature /K | pressure /Pa |
|---|-------------------|----------------|--------------------|
| A | carbon dioxide | 250 | 1.00×10^5 |
| B | hydrogen chloride | 1000 | 1.00×10^6 |
| C | nitrogen | 1000 | 1.00×10^5 |
| D | oxygen | 250 | 1.00×10^6 |

40 The diagram shows the relative abundance of different isotopes of lead in a sample of lead ore. The abundance of 208 is half that of 206. The abundances of 208 and 209 are equal.



What is the relative atomic mass of the lead in the sample?

- A 207.00 B 207.25 C 207.50 D 207.67

14 A mixture of the three gases, oxygen, nitrogen and argon, is at a total pressure of 500 kPa. There is a total of 1.2 moles of gas in the mixture.

If the oxygen gas alone occupied the entire volume of the mixture, it would exert a pressure of 150 kPa.

At room conditions the amount of nitrogen gas in the mixture would occupy a volume of 5.76 dm^3 .

What is the partial pressure of the argon gas in the mixture?

- A 150 kPa
B 200 kPa
C 250 kPa
D 300 kPa

5 Separate samples, each of mass 1.0 g, of the compounds listed are treated with an excess of dilute acid.

Which compound releases the largest amount of CO_2 ?

- A 1.0 g CaCO_3 B 1.0 g Li_2CO_3 C 1.0 g MgCO_3 D 1.0 g Na_2CO_3