1.2 Reacting Masses & Volumes

Question Paper

Course	DP IB Chemistry
Section	1. Stoichiometric Relationships
Topic	1.2 Reacting Masses & Volumes
Difficulty	Medium

To be used by all students preparing for DP IB Chemistry HL
Students of other boards may also find this useful

Question 1

A periodic table is needed for this question

A 2.27 dm^3 sample of nitrogen gas, measured under standard conditions, reacted with a large excess volume of hydrogen gas to produce ammonia. Only 20.0% of the nitrogen gas reacted to produce ammonia.

What mass of ammonia was made?

A. 0.20 g

B. 0.34 g

C. 0.68 g

D. 1.36 g

[1 mark]

Question 2

A periodic table is needed for this question

Excess aqueous cold sodium hydroxide is reacted with 0.10 mol of chlorine gas, Cl_2. One of the products is a compound of sodium, oxygen and chlorine.

What mass of the product is formed?

A. 3.54 g

B. 7.44 g

C. 14.8 g

D. 26.6 g

[1 mark]

Question 3

A periodic table is needed for this question

When heated, anhydrous magnesium nitrate, $Mg(NO_3)_2$, will decompose into magnesium oxide and a mixture of gases shown in the following equation

$$2Mg(NO_3)_2(s) \rightarrow 2MgO(s) + 4NO_2(g) + O_2(g)$$

1.48 g of anhydrous magnesium nitrate is heated until no further reaction takes place.

What mass of nitrogen dioxide is produced?

A. 0.92 g

B. 0.46 g

C. 1.48 g

D. 1.84 g

[1 mark]

Question 4

A periodic table is needed for this question

A hydrocarbon, X, was burned in excess oxygen to give carbon dioxide and water as the only products. 0.1mol of X produced 9.08dm^3 of carbon dioxide at standard conditions.

What is the molecular formula of X?

A. CH_4

B. C_2H_6

C. C_3H_8

D. C_4H_{10}

[1 mark]

Question 5

A periodic table is needed for this question

A Group II metal of mass 0.65 g reacted with 606.9 cm^3 of oxygen at 273 K and 100 kPa pressure, to form an oxide which contains O^{2-} ions.

The molar mass of the metal is found using which of the following calculations?

A. $\frac{22.7 \times 0.65}{606.9}$

B. $\frac{22.7 \times 1000 \times 0.65}{606.9}$

C. $\frac{606.9 \times 1000 \times 0.65}{22.7}$

D. $\frac{22.7 \times 1000 \times 606.9}{0.65}$

[1 mark]

Question 6

A periodic table is needed for this question

Solid fertilisers often contain the elements N, P and K in a ratio of 20 g : 30 g : 10 g per 100 g of fertiliser. It is recommended that the fertiliser is used at 14 g of fertiliser per 5 dm^3 of water.

What is the concentration of nitrogen atoms in the solution?

A. 0.02 mol dm^{-3}

B. 0.03 mol dm^{-3}

C. 0.04 mol dm^{-3}

D. 0.05 mol dm^{-3}

[1 mark]

Question 7

An experiment is conducted to calculate the M_r of an unknown gas of known mass.

Measurements of pressure, volume and temperature are taken during the experiment.

Which conditions of temperature and pressure would give the most accurate value of M_r?

[1 mark]

	pressure	temperature
A	low	high
B	low	low
C	high	high
D	high	low

Question 8

0.96 g of hydrogen gas is contained in a sealed vessel of volume of 7.0×10^{-3} m^3 at a temperature of 303 K.

Assume the gas behaves as an ideal gas.

What is the pressure of the vessel in Pa?

A. $\frac{2.02 \times 7.0 \times 10^{-3}}{0.96 \times 8.314 \times 303}$

B. $\frac{0.96 \times 8.314 \times 303}{2.02 \times 7.0 \times 10^{-3}}$

C. $\frac{0.96 \times 8.314 \times 303}{7.0 \times 10^{-3}}$

D. $\frac{0.96 \times 8.314 \times (303 + 273)}{2.02 \times 7.0 \times 10^{-3}}$

[1 mark]

Question 9

A 5370 cm^3 sample of oxygen is measured at a temperature of 60°C. The pressure measured was 103,000 Pa.

Assume the gas behaves as an ideal gas.

What is the mass of the sample of oxygen?

A. $\frac{103000 \times 0.00537 \times 32.00}{8.314 \times 60}$

B. $\frac{103000 \times 0.00537 \times 32.00}{8.314 \times 333}$

C. $\frac{103 \times 0.00537 \times 32.00}{8.314 \times 333}$

D. $\frac{103000 \times 5370 \times 32.00}{8.314 \times 333}$

[1 mark]

Question 10

A sample of chlorine gas with a of mass 5.35 g has a volume of 1.247×10^{-3} m^3 at a pressure of 1.00×10^5 Pa.

Assuming that the gas acts as an ideal gas, what is the temperature of the gas in K?

A. $\frac{5.35 \times 1.0 \times 1.247}{(70.90 \times 8.314)}$

B. $\frac{5.35 \times (1.0 \times 10^5) \times (1.247 \times 10^{-3})}{(8.314)}$

C. $\frac{5.35 \times (1.0 \times 10^5) \times (1.247 \times 10^{-3})}{(70.90 \times 8.314)}$

D. $\frac{70.90 \times (1.0 \times 10^5) \times (1.247 \times 10^{-3})}{(5.35 \times 8.314)}$

[1 mark]

Question 11

A bubble travelled up from the sea bed to the surface. Just below the surface of the sea the bubble had a volume of 200 cm^3 at a pressure of 101 kPa. The temperature at the surface is the same as at the sea bed.

The pressure at the sea bed is 2020 kPa.

What is the volume of the bubble at the sea bed?

A. 10 cm^3

B. 200 cm^3

C. 100 cm^3

D. 1000 cm^3

[1 mark]

Question 12

Sodium reacts with water in the equation below.

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$$

Which mass of sodium reacts with water to produce 960 cm^3 of hydrogen gas at 100kPa and 20°C?

A. $\frac{8.314 \times 293}{100000 \times 0.00096 \times 2 \times 22.99}$

B. $\frac{100000 \times 0.00096 \times 2 \times 22.99}{8.314 \times 293}$

C. $\frac{100000 \times 960 \times 2 \times 22.99}{8.314 \times 293}$

D. $\frac{100000 \times 0.00096 \times 22.99}{8.314 \times 293}$

[1 mark]

Question 13

When a sample of a gas is compressed at room temperature from 101kPa to 300 kPa, its volume changes from 50.0 cm^3 to 17.5 cm^3.

Which statement best describes why this happens?

A. the gas is behaving ideally

B. the gas behaves non-ideally

C. gas is absorbed on to the vessel walls

D. the gas partially liquifies

[1 mark]

Question 14

A periodic table is needed for this question

What mass of a methane, CH_4, would occupy a volume of 3 dm^3 at 25°C and 100 kPa pressure?

A. $\frac{100000 \times 3 \times 16.05}{8.314 \times 298}$

B. $\frac{100 \times 0.003 \times 16.05}{8.314 \times 298}$

C. $\frac{100000 \times 0.003 \times 16.05}{8.314 \times 25}$

D. $\frac{100000 \times 0.003 \times 16.05}{8.314 \times 298}$

[1 mark]

Question 15

Which expression gives the pressure exerted by 1.5 $\times 10^{-2}$ mol of carbon dioxide in a container of volume 2 dm^{-3} at 275°C?

A. $\frac{(1.5 \times 10^{-2}) \times 8.31 \times 275}{2 \times 10^{-6}}$

B. $\frac{(1.5 \times 10^{-2}) \times 8.31 \times (275 + 273)}{2 \times 10^{-6}}$

C. $\frac{(1.5 \times 10^{-2}) \times 8.31 \times (275 + 273)}{2 \times 10^{-3}}$

D. $\frac{(1.5 \times 10^{-2}) \times 8.31 \times 275}{2 \times 10^{-3}}$

[1 mark]