HL Paper 1

At which temperature, in K, assuming constant pressure, is the volume of a fixed mass of gas at 127 °C doubled?

A. 200 K

B. 254 K

C. 400 K

D. 800 K

Markscheme

D

Examiners report

[N/A]

$300\ \mathrm{cm}^3$ of water is added to a solution of $200\ \mathrm{cm}^3$ of $0.5\ \mathrm{mol\,dm}^{-3}$ sodium chloride. What is the concentration of sodium chloride in the new solution?

A. $0.05\ \mathrm{mol\,dm}^{-3}$

B. $0.1\ \mathrm{mol\,dm}^{-3}$

C. $0.2\ \mathrm{mol\,dm}^{-3}$

D. $0.3\ \mathrm{mol\,dm}^{-3}$

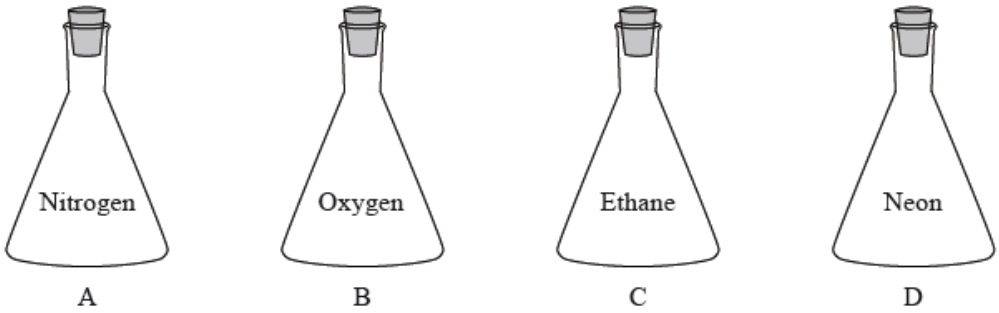
Markscheme

C

Examiners report

One respondent stated that it would be best to start HLP1 with a mole type question and that these first three questions could have potentially tripped up candidates at the beginning of this paper. It must be emphasised that P1 covers all topics on the syllabus and, hence, any question can be asked as an Objective 1 or 2 multiple-choice type question based on any of the corresponding AS"s on Topic 1 - Quantitative Chemistry. As regards the questions themselves, none of these three questions, in fact, posed a significant problem for candidates. 76% of candidates got Q1 correct, 68% Q2 and 78% Q3.

Four identical containers under the same conditions are filled with gases as shown below. Which container and contents will have the highest mass?



Markscheme

B

Examiners report

[N/A]

What is the pressure, in Pa, inside a 1.0 m^3 cylinder containing 10 kg of H_2 (g) at 25 °C?

R = 8.31 J K^{-1} mol^{-1}; $pV = nRT$

A. $\frac{1\times10^4\times8.31\times25}{1.0\times10^3}$

B. $\frac{5\times10^2\times8.31\times298}{1.0}$

C. $\frac{1\times8.31\times25}{1.0\times10^3}$

D. $\frac{5\times10^3\times8.31\times298}{1.0}$

Markscheme

D

Examiners report

[N/A]

A compound with M_r = 102 contains 58.8 % carbon, 9.80 % hydrogen and 31 % oxygen by mass.

What is its molecular formula?

A_r: C = 12.0; H = 1.0; O = 16.0

A. $C_2H_{14}O_4$

B. $C_3H_4O_4$

C. $C_5H_{10}O_2$

D. $C_6H_{14}O$

Markscheme

C

Examiners report

[N/A]

Which solution neutralizes 50.0 cm^3 of 0.120 mol dm^{-3} NaOH (aq)?

A. 12.5 cm^3 of 0.080 mol dm^{-3} H_3PO_4

B. 25.0 cm^3 of 0.120 mol dm^{-3} CH_3COOH

C. 25.0 cm^3 of 0.120 mol dm^{-3} H_2SO_4

D. 50.0 cm^3 of 0.060 mol dm^{-3} HNO_3

Markscheme

C

Examiners report

[N/A]

What mass, in g, of hydrogen is formed when 3 mol of aluminium react with excess hydrochloric acid according to the following equation?

$$2\mathrm{Al(s)} + 6\mathrm{HCl(aq)} \rightarrow 2\mathrm{AlCl_3(aq)} + 3\mathrm{H_2(g)}$$

A. 3.0

B. 4.5

C. 6.0

D. 9.0

Markscheme

D

Examiners report

[N/A]

Which coefficients would balance this equation?

$$\_\_\ MnO_2 + \_\_\ HCl \rightarrow \_\_\ MnCl_2 + \_\_\ Cl_2 + \_\_\ H_2O$$

	MnO_2	HCl	$MnCl_2$	Cl_2	H_2O
A.	1	2	1	1	1
B.	1	3	1	1	1
C.	1	4	1	1	2
D.	1	4	1	2	2

Markscheme

C

Examiners report

In spite of a concern on the part of one teacher that this question was too difficult, this was one of the questions that students found easiest, with a Difficulty Index of 94%; hence it provided a nice easy start to settle students into the paper.

4.0 g of solid sodium hydroxide is added to $0.10\ dm^3$ of $1.0\ mol\ dm^{-3}$ aqueous sulfuric acid.

$$2NaOH(s) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$$

Which statement is correct?

A. Neither reactant is in excess.

B. 0.10 mol Na_2SO_4 is formed.

C. Excess H_2SO_4 remains in solution.

D. Excess NaOH remains in solution.

Markscheme

C

Examiners report

[N/A]

What are the coefficients of $\mathrm{H_2SO_4(aq)}$ and $\mathrm{H_3PO_4(aq)}$ when the following equation is balanced using the smallest possible whole numbers?

$$\_\_\_\ \mathrm{Ca_3(PO_4)_2(s)} + \_\_\_\ \mathrm{H_2SO_4(aq)} \rightarrow \_\_\_\ \mathrm{CaSO_3(s)} + \_\_\_\ \mathrm{H_3PO_4(aq)}$$

	Coefficient of $\mathrm{H_2SO_4(aq)}$	Coefficient of $\mathrm{H_3PO_4(aq)}$
A.	1	2
B.	2	3
C.	3	1
D.	3	2

Markscheme

D

Examiners report

[N/A]

What volume of carbon dioxide, in $\mathrm{dm^3}$ under standard conditions, is formed when 7.00 g of ethene $(\mathrm{C_2H_4},\ M_\mathrm{r} = 28.1)$ undergoes complete combustion?

A. $\frac{22.4 \times 28.1}{7.00}$

B. $\frac{22.4 \times 7.00}{28.1}$

C. $\frac{2 \times 22.4 \times 28.1}{7.00}$

D. $\frac{2 \times 22.4 \times 7.00}{28.1}$

Markscheme

D

Examiners report

[N/A]

Under which conditions does $\mathrm{CH_4}$ have the same number of molecules as $100\ \mathrm{cm^3}$ of $\mathrm{O_2}$ at 27 °C and $1.0 \times 10^5\ \mathrm{Pa}$?

	Volume / cm^3	Temperature / °C	Pressure / 10^5 Pa
A.	50	54	1.0
B.	50	327	1.0
C.	100	54	2.0
D.	100	327	2.0

Markscheme

D

Examiners report

Some teachers were worried about the use of a skeletal formula for the benzene ring. Certainly skeletal formulas are not on the syllabus but the benzene ring is.

7.102 g of **Na_2SO_4 (*M* = 142.04 g mol^{-1})** is dissolved in water to prepare $0.5000\ \mathrm{dm^3}$ of solution. What is the concentration of $\mathrm{Na_2SO_4}$ in $\mathrm{mol\,dm^{-3}}$?

A. 2.500×10^{-2}

B. 1.000×10^{-1}

C. 1.000×10

D. 1.000×10^{2}

Markscheme

B

Examiners report

[N/A]

Which expression gives the sum of all the coefficients for the general equation for the complete combustion of hydrocarbons?

$$\_\_\ \mathrm{C}_x\mathrm{H}_y(\mathrm{g}) + \_\_\ \mathrm{O}_2(\mathrm{g}) \rightarrow \_\_\ \mathrm{CO}_2(\mathrm{g}) + \_\_\ \mathrm{H}_2\mathrm{O}(\mathrm{l})$$

A. $1 + x + \frac{y}{4}$

B. $1 + x + \frac{y}{2}$

C. $1 + 2x + \frac{3y}{4}$

D. $1 + 2x + \frac{3y}{2}$

Markscheme

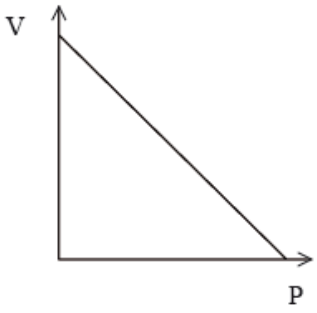
C

Examiners report

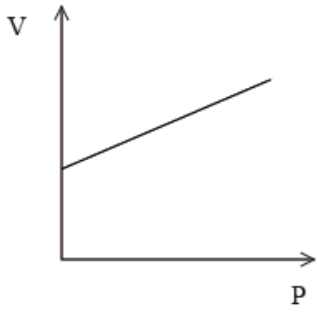
Although this might have seemed unfamiliar, nearly 50% gave the correct answer. Many thought this was too challenging for an early question. The examination questions are, and have been for many years, presented in topic order. Those candidates who find the more mathematical manipulation testing should, perhaps, be advised the tackle the questions in a different order.

Which graph represents the relationship between volume and pressure for a fixed mass of gas at constant temperature?

A.



B.



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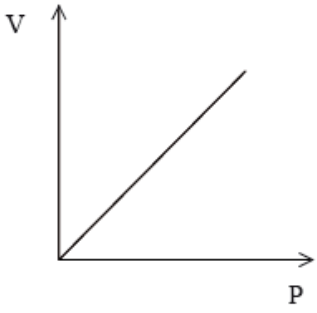
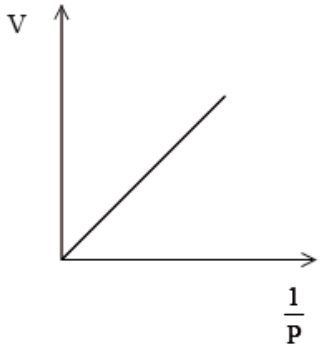


D.



Markscheme

D

Examiners report

[N/A]