MEMO GR. 11 SCIENCE P2 JUNE 2022

1.1 B 1.2 B 1.3 C 1.4 C 1.5 D 1.6 A 1.7 C 1.8 D 1.9 A 1.10 D

2.1 The <u>mutual attraction between two atoms</u> ✓ resulting from the <u>simultaneous attraction between their nuclei and the outer electrons</u>. ✓ (2)

2.2 Internuclear distance. ✓ (1)

2.3 ✓ Axes labels with units ✓ Shape ✓ (109; -946) (3)

[6]

3.1 A pair of electrons that is shared between two atoms ✓ in a covalent bond. ✓ (2)

3.2.1 ✓ Bonding partners with correct shape ✓ Number of electrons (2)

3.2.2 4 ✓ + marking from 3.2.1 (1)

3.2.3 NON-POLAR ✓ bonds. $\Delta E.N. = 2{,}5 - 2{,}5 = 0$ ✓ (2)

3.3 ✓ Bonding partners with correct shape
✓ Number of bonds ✓ Partial charges (3)

3.4 POLAR ✓ molecule since there is an <u>asymmetrical charge distribution</u>. ✓ (2)

3.5.1 ✓ NH_3 ✓ H^+ ✓ NH_4^+ (3)

3.5.2 Dative covalent bond. ✓ (1)

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4.1 The vapour pressure of a substance is the pressure of gas molecules of the substance in contact with its liquid or solid form. OR The pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓ (2 or 0) (2)

4.2 The larger the molecular mass, the higher the boiling point. ✓✓
(**0/2** if the phrase “directly proportional” is used as the graph is NOT a straight-line passing through the origin). (2)

4.3 Gas ✓ phase. (1)

4.4 SnH_4 ✓ SnH_4 has the highest boiling point ✓ and vapour pressure is inversely proportional to boiling point. ✓ (3)

4.5
- Both SiH_4 and GeH_4 have London forces between their molecules. ✓
- SiH_4 has weaker London forces than GeH_4 since it has a smaller molecular mass. ✓
- ∴ Less energy is required to break the London forces of SiH_4 resulting in a lower boiling point. ✓ (3)

4.6 Carbon tetrachloride (accept: $CC\ell_4$). ✓
Both CH_4 and $CC\ell_4$ are non-polar molecules. ✓ (like dissolves like). (2)

4.7
- NH_3 has hydrogen bonds between its molecules whilst CH_4 has London forces between its molecules. ✓
- Hydrogen bonds are stronger than London forces. ✓
- ∴ More energy is required to break the hydrogen bonds ✓ (resulting in a higher boiling point for NH_3). (3)

[16]

5.1 The energy absorbed or released per mole in a chemical reaction. ✓✓ (2 or 0) (2)

5.2 Activated complex. ✓ (1)

5.3 EXOTHERMIC. ✓ The energy of the products is less than the energy of the reactants ✓ meaning energy was released. (2)

5.4.1 $E_A = 490 - 210$ ✓ $= 280\ kJ.mol^{-1}$ ✓ (2)

5.4.2 $\Delta H = 70 - 210$ ✓ $= -140\ kJ.mol^{-1}$ ✓ (2)

5.4.3 Total Energy Released $= (\pm)\ (490 - 70)$ ✓ $= (\pm)\ 420\ kJ.mol^{-1}$ ✓ (2)

[11]

6.1.1 The simplest, whole-number ratio of atoms in the compound. ✓✓ (2 or 0) (2)

6.1.2

Element	$n = \frac{m}{M}$	Ratio	Whole Number
C	$\frac{84,21}{12} = 7,0175$	$\frac{7,0175}{7,0175} = 1$	$1 \times 4 = 4$
H	$\frac{15,79}{1} = 15,79$	$\frac{15,79}{7,0175} = 2,25$	$2,25 \times 4 = 9$
	✓	✓	

$\therefore C_4H_9$ ✓ (3)

6.2.1

$c = \frac{m}{MV}$ √

$0,25 = \frac{m}{(114\ \sqrt{\text{calculating M}})(140)}$ √

$\therefore m = 3\,990\ g$ ✓

$c = \frac{n}{V} \implies 0,25 = \frac{n}{140}$

$\therefore n = 35\ mol$ ✓

$n = \frac{m}{M}$ √any formula

$35 = \frac{m}{114\ \sqrt{\text{calculating M}}}$

$\therefore m = 3\,990\ g$ ✓ (4)

6.2.2

$2\ C_8H_{18} + 25\ O_{2(g)}$ √reactants $\rightarrow 16\ CO_{2(g)} + 18\ H_2O_{(g)}$ √products

$V_{O_2} = 400 \times 0,21 = 84\ dm^3$ ✓

$n = \frac{V}{V_m}$ √formula $= \frac{84}{26}$ √substitution $= 3,23 \ldots\ mol$

$n_{CO_2} = \frac{16}{25} \times n_{O_2}$ √ratio $= \frac{16}{25} \times 3,23 \ldots = 2,06 \ldots\ mol$

$n = \frac{N}{N_A}$ √formula

$2,06 \ldots = \frac{N}{6,02 \times 10^{23}}$

$N = 1,24 \times 10^{24}$ √ CO_2 molecules released per second

(maximum 4/8 if the equation is not balanced or balanced incorrectly) (8)

[17]

7.1 The reactant which is completely used up in a reaction.

OR

The reactant which determines how much product forms. ✓ (1)

7.2.1 H_2 ✓ (1)

7.2.2 $n_{H_2O} = n_{H_2} = 20\,000\ mol$ ✓

$n = \frac{m}{M}$ √formula

$20\,000 = \frac{m}{18}$

$\therefore m = 360\,000\ g$ ✓ (3)

7.2.3 n_{O_2} (leftover) $= 10\,000\ mol$ ✓

$n = \frac{V}{V_m}$ √formula

$10\,000 = \frac{V}{22{,}4}$

$\therefore V = 224\,000\ dm^3$ ✓ (3)

7.3 2:1 ratio of hydrogen to oxygen ✓ , i.e. two parts hydrogen, one part oxygen. (1)

7.4 Rocket fuel produces H_2O only. ✓ F1 fuel also produces CO_2 ✓ (a greenhouse gas which contributes to climate change). (2)

7.5 $n = \frac{m}{M} = \frac{250\,000}{32}$ √calculating n $= 7\,812{,}5\ mol$

Energy Released $= -188 \times 7\,812{,}5$ √ $= -1\,468\,750\ kJ$ √ (3)

[14]