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Complete, fold and seal
(see note 2 below)

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Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either read your script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

1	Student Number	2425617
2	Title of Examination Paper	OME Chemistry
3	Module Code	ACDB4011
4	Date and Time of Examination	06/05/25
5	Examination Venue	1Q310
6	Seat Number	7
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	7.5
2	10
3	7.5
4	5
5	8.5
6	5
7	2.5
8	1
9	~~15~~
10	~~15~~
Total	49.5

Question 1

7.5

1A) True ✓

1B) false ✓

1C) ~~True~~

$$1d) H_2O \text{ mm} = (1 \times 2) + 16 = 18$$

$$\text{mol} = \frac{\text{mass}}{\text{mm}} = \frac{0.5}{18} = 0.278 \text{ mol}$$

$$0.278 \times 6.02 \times 10^{23} = 2.78 \times 10^{22}$$

~~false~~

e)



$\Delta H = 50 \text{ KJ}$



$\Delta H = -30 \text{ KJ}$



$= +100 \text{ KJ}$

$$(1) 50 \text{ KJ} + (2) +30 \times 2$$

~~True~~ ✓

1g) false ✓

1h) ~~True~~ ✓

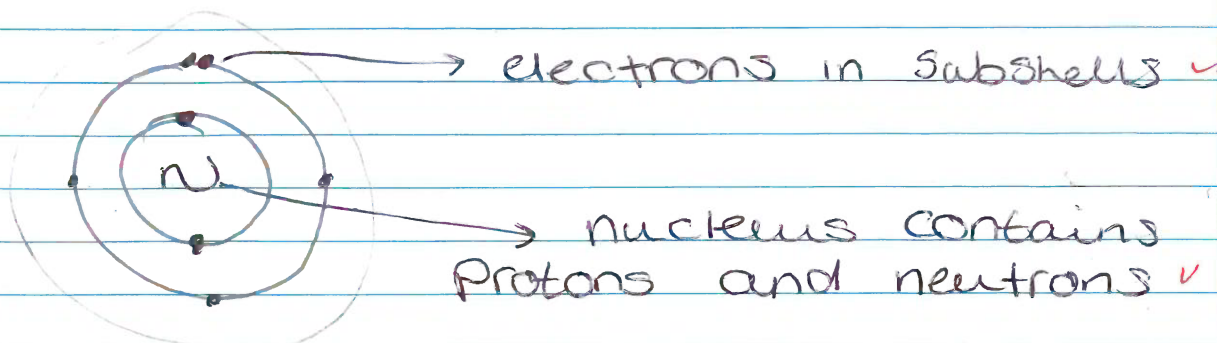
1i) True ✓

1j) True, lowers activation energy
~~False~~ ~~True~~

7.5

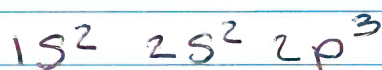
Question 2

2a)



3p

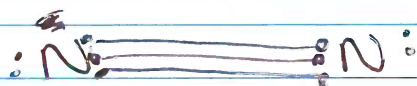
Protons = 7 (positive charge)
 Neutrons = $15 - 7 = 8$ (no charge) ✓
 electrons = 7 (negative charge) ✓



2b) The charge will -3 as it will ✓
 gain electrons

2p

2c)



3p

3 electrons from each atom used to form triple bond, very ~~3~~ strong electrostatic attraction between them.

requires lots of energy to break these bonds, short bond length

2d) The significance of the nitrogen-nitrogen bond is that due to a lot of energy being required to break them, ~~when~~ ^{formed} reacting and these bonds are ~~broken~~ a very high amount of energy is released which is required for explosives / munitions. In comparison to the oxygen bonds it differs due

2p

10

to this being a double bond which is longer and requires less energy to break them.

Question 3

3a)

$$c = h \times f$$

$$\frac{616 \text{ nm} \rightarrow \text{m}}{6 \times 10^{-9}} \rightarrow \text{m}$$

3.5p

$$E = h \times f$$

$$6.10 \times 10^{-9}$$

$$3.0 \times 10^8 \text{ m/s} = 6.16 \times 10^{-9} \times f$$

$$f = \frac{6.16 \times 10^{-9} \text{ m}}{3.0 \times 10^8 \text{ m/s}} = \frac{616 \times 10^{-9} \text{ nm}}{3.0 \times 10^8 \text{ m/s}} = 2.0533 \times 10^{-17} \text{ Hz}$$

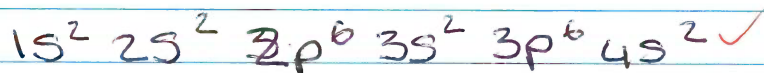
$$E = 6.6 \times 10^{-34} \times 2.0533 \times 10^{-17}$$

$$f = \frac{3.0 \times 10^8 \text{ m/s}}{6.16 \times 10^{-9} \text{ m}} = 4.87 \times 10^{16} \text{ Hz}$$

$$E = 6.6 \times 10^{-34} \times 4.87 \times 10^{16} = 3.214 \times 10^{-17} \text{ J}$$

3b) Calcium = Ca

4p



calcium has only 2 unpaired electrons in its outermost shell.

3c)

metals

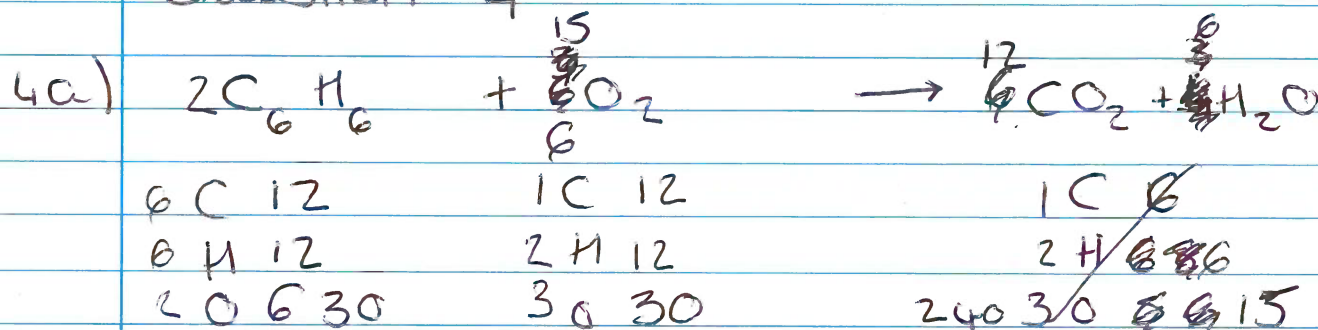
Salts are used in pyrotechnics because when they are heated and the electrons from the outermost shell become excited they absorb this heat energy and temporarily enter a higher energy level. These electrons do

3p

1.5

not have enough energy to remain in this excited state so will return back to its ground state, this process release energy in the form of light which is visible ✓ on the emission spectra. Different salt ions produce different colours as the ~~you~~ have wavelengths ✓

Question 4



$$mol = \frac{mass}{mm}$$

$$mm \text{ of } C_6H_6 = (12 \times 6) + (1 \times 6) = 78 \checkmark$$

$$mol = \frac{27.0g}{78} = 0.346 \text{ mol} \checkmark$$

$$\text{CO}_2 = 12 + (16 \times 2) \\ = 44 \checkmark$$

$$\text{mol} \times \text{mm} = \text{mass} \\ 0.346 \text{ mol} \times 44 = 15.224 \text{ g}$$

$$\text{H}_2\text{O} = (1 \times 2) + 16 = 18 \checkmark$$

$$\text{mol} \times \text{mm} = \text{mass} \quad 0.346 \times 18 = 6.228 \text{ g}$$

4d) $PV = nRT \checkmark$

1p

4e) $\text{mol} = \cancel{\text{conc}} \times \text{vol}$

0p

Question 3

5a) The oxygen balance is the concept that a compound is completely combusted in oxygen - this is significant as it can determine how much of different gases will be produced / how efficient the reaction is. ✓

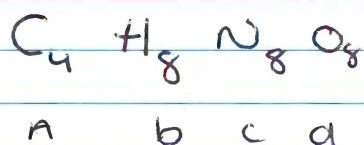
1.5p

$$5b) n = \frac{16}{\text{mol}} \left[d - (2a) - \left(\frac{b}{2} \right) \right] \times 100\%$$

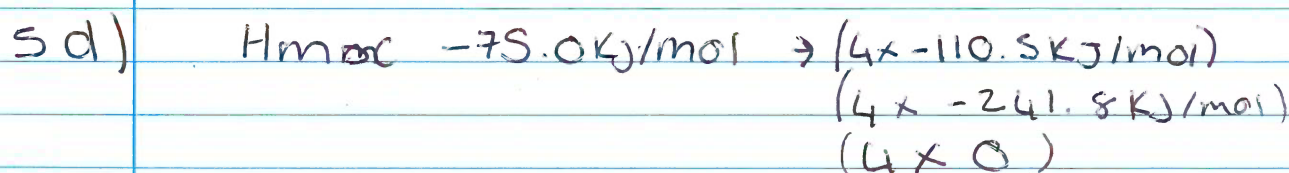
$$= \frac{16}{296.15} \left[8 - (2 \times 4) - \left(\frac{8}{2} \right) \right] \times 100\%$$

4p

$$= -21.611\% \quad \checkmark$$



2p



4p

$$\checkmark -75.0 \text{ kJ/mol} \rightarrow (-442) + (-967.2) + 0$$

$$\rightarrow -1409.2 \text{ kJ/mol} \quad \checkmark$$

ΔH not calculated

The reaction is ~~exothermic~~ endothermic

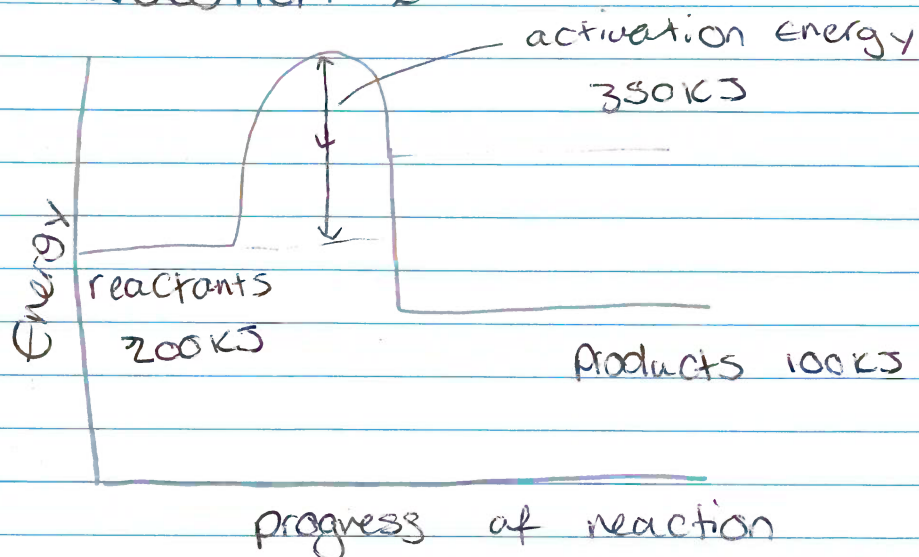
5e) Combustion of TNT is a ~~exothermic~~ endothermic reaction, Hmx combustion is ~~exothermic~~ endothermic and the system takes in ~~about~~ -1406.4 kJ/mol - more reactive.

0p

8.5

Question 6

6a)



2p

6b)

This reaction is endothermic ✓
 and ~~fig~~ has a high activation ✓ energy
 due to the strong intermolecular
 van der Waals forces.

3p

5

Question 8

$$8a) \text{ moles} = \text{conc} \times \text{vol}$$

$$\frac{\text{moles}}{\text{vol}} = \text{conc}$$

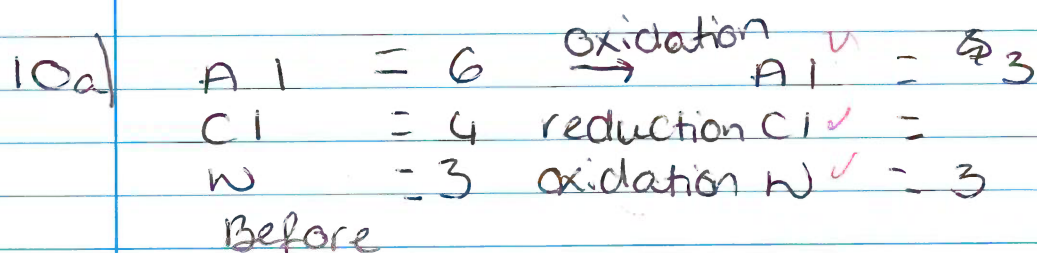
$$\frac{0.50 \text{ mol}}{1000} = 0.0005$$

$$\frac{0.2103 \text{ KOH}}{0.0428} = 4.915 \text{ mol/L}$$

$$\text{HNO}_3 \text{ Concentration} = 4.915 \text{ mol/L}$$



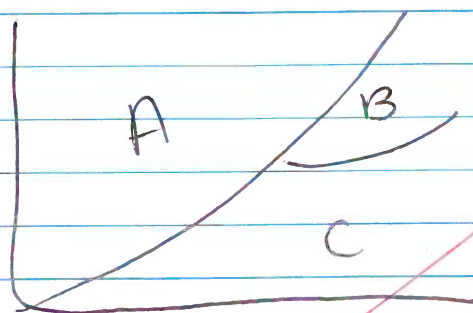
Question 10



oxidation is loss
reduction is gain

Question 7.

7a



A = solid
B = liquid
C = gas

7a)

It's important to understand at what phase the high energy material is most stable - as this could help ~~min~~ minimise risk of accidental detonation. Allow a design to be able to contain the substance at the relevant temperature and pressure to keep it in required state.

3p

~~7a)~~
7b)

30 atm
500 °C

0.5p

3.5