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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 over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either read your illegible 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.

Complete, fold and seal
(see note 2 below)

SURNAME: Shay

FORENAME(S): Pippa

1	Student Number	2417658
2	Title of Examination Paper	ACDB4011 OME Chemistry BEng
3	Module Code	ACDB4011
4	Date and Time of Examination	6th May 2025
5	Examination Venue	10310
6	Seat Number	12
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	10.5
2	8
3	7.5
4	8
5	5.5
6	1.5
7	11.5
8	0
9	4
Total	58.5

10.5

a ~~False~~ - the only energies that are potential are elastic and gravitational

b false - atomic number is the number of protons.

c true

~~d~~

d true - as 1 mole has 12.04×10^{23} ~~so~~ atoms of hydrogen as there are two atoms that make up one molecule so 0.5 moles = 6.02×10^{23} which is Avogadro's constant.

e false - as oxygen naturally exists as O_2 so three moles of that would give 6 oxygen molecules not 3

~~f~~ false - NH_3 is a lighter molecule therefore according to Graham's law should move faster.

~~g~~

h true as it is ^{inter particle} ~~inter molecular~~ forces holding them together

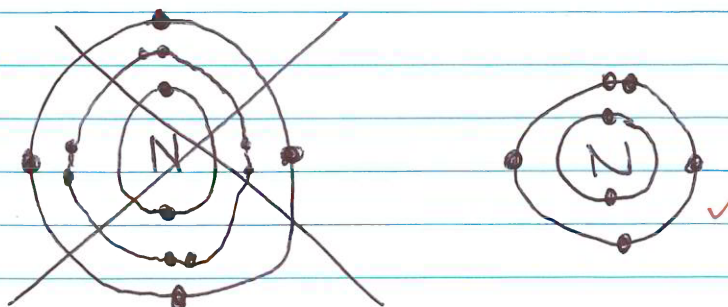
i false a catalyst reduces the activation energy.

f true - because $2C \rightarrow 2D = \Delta H \text{ of } -60 \text{ KJ}$ then
 $50 \text{ KJ} - -60 \text{ KJ} = +110 \text{ KJ}$

i true - the fuel needs oxygen to combust.

10.5

2a



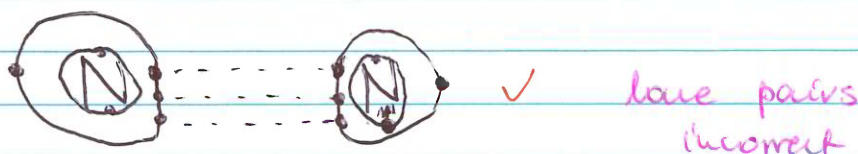
1p

b) -3

 N^{-3} ✓

2p

c



3p

triple bond so has lots of energy ✓

✗

d as it is a triple bond is it a shorter bond with more energy compared to oxygen double bond so useful in OME as will have more energy per molecule.

3p

3a

$$c = f \times \lambda$$

$$f = \frac{3 \times 10^8 \text{ ms}^{-1}}{616 \times 10^{-9} \text{ m}} = 4.87012987 \times 10^{11} \text{ s}^{-1}$$

3.5p

$$e = h \times f$$

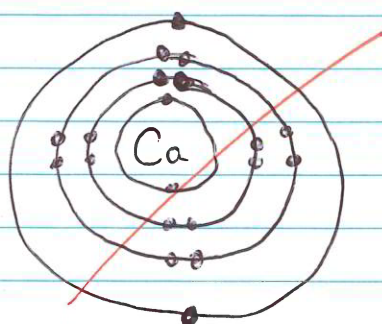
$$e = 6.6 \times 10^{-34} \text{ Js} \times 4.87012987 \times 10^{11} \text{ s}^{-1} = 1.3552 \times 10^{-22} \text{ J}$$

$$e = 6.6 \times 10^{-34} \times 4.87012987 \times 10^{11} = 3.2 \times 10^{-22} \text{ J}$$

14.5

b $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ ✓

1p

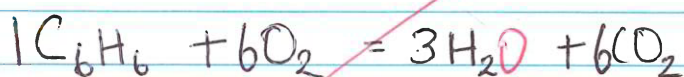


2 unpaired electrons in the ~~valence~~ shell.

c When atoms are heated their electrons are excited from their ground state then when they cool then return back to their ground state, this emits photons of light ~~and~~ ^{with} their wavelengths being related to the energy difference in the levels, this gives the emission spectra, the absorption spectra is similar as those colours ^{wavelengths} that are produced from the emission spectra are missing ~~in~~ the absorption spectra. This can be used in pyrotechnics as once an element has been found that produces the desired wavelength and colour this can be used to make the pyrotechnic.

3p

4a



4p

b

$$27g \text{ ~~mm~~ } \rightarrow 78g/mol$$

$$27 \times \frac{26}{9} = 78$$

for H_2O

$$mm = 2g/mol \rightarrow 6g \times \frac{9}{26} = 2.08g$$

4p

for O_2

$$mm = 32g/mol \rightarrow 192g \times \frac{9}{26} = 66.5g$$

for CO_2 , $mm = 44g/mol$

$$\rightarrow 264 \times \frac{9}{26} = 91.4g$$

$$\text{Total mass of gas products} = 91.4 + 2.08 = 92.5g$$

d at STP 22.4 dm^3 - this could be used in $\checkmark$
 (there was noc) $PV = nRT \checkmark$ for H_2 alternative method. $\checkmark$

$$1V = 3 \times 0.0821 \times 273.15$$

$$V = 672.276845 \text{ L} \rightarrow V = 673 \text{ L}$$

for CO_2

$$1 \times V = 6 \times 0.0821 \times 273.15$$

$$V = 134.55369 \rightarrow 135 \text{ L}$$

$$67.3 + 135 = 202 \text{ L}$$

e $P = k \frac{1}{V} \checkmark$ $P = kT \checkmark$

$$P \uparrow \therefore V \downarrow$$

5a oxygen balance shows the excess oxygen left at the end of a reaction or the oxygen debt left at the end of a reaction, the best reactions have an oxygen balance of zero, not too much or too little oxygen meaning the reaction will definitely happen because if there is not enough oxygen it may not happen and excess oxygen is not good either because then not all of the reactants react.

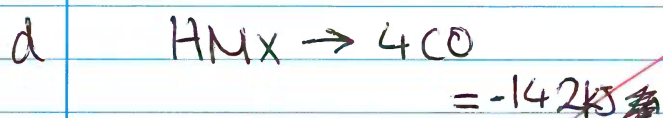
3p

b

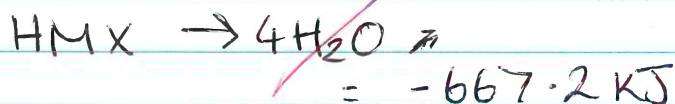
0p



2p



0.5p



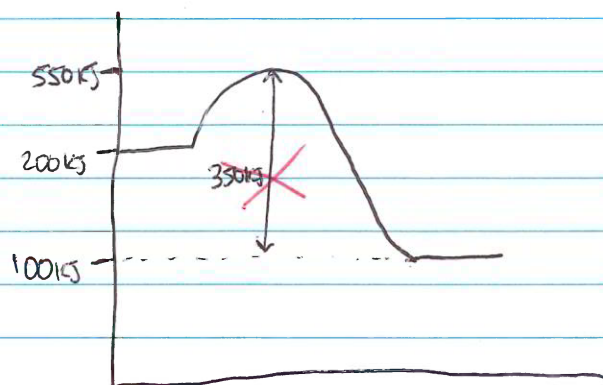
the process was exothermic.

e) this process creates significantly more heat a similar amount of heat as 1 mole of TNT which is ~~-636~~ -636 kJ of energy. So ?
~~not to mole TNT creates more energy as~~

0p

5.5

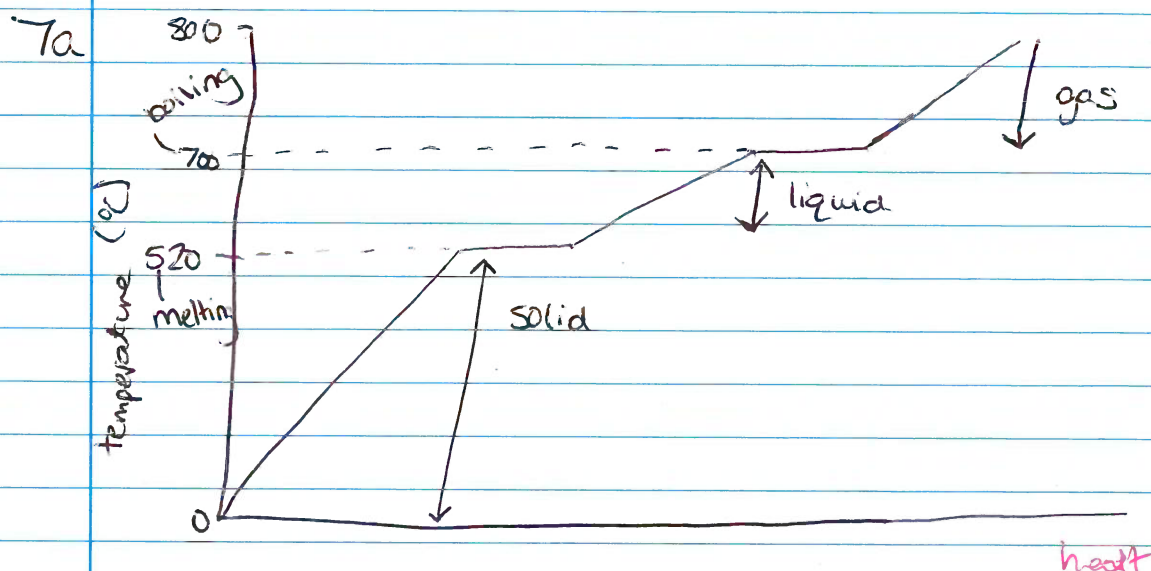
ba



enthalpy = -100 kJ ✓

b

op



3p

- b) ~~B~~ 500°C at 35 atm, melting, freezing, boiling, condensing, evaporation, sublimation.
triple point

2.5

- c) the stronger the intermolecular forces the further to the ~~top~~ right the graph shifts as it will take more energy to break bonds. H_2O has a boiling point of 100°C as its hydrogen bonds are very strong and take a lot of ~~force~~ ^{energy} to break.

3p

- d) you need to know what state your substance will be in in the range of temperatures it will be stored in. This is important so you know how to store it as a gas may need to be more tightly stored ~~as~~ ^{than} a solid. This may also be important if the substance is highly reactive in some states.

3p

11.5

8a

~~mass~~
~~mass~~ molarity

9p

$$\cancel{0.04280} \frac{42.80g}{0.2403M} = 203.0 g/mol$$

$$\text{molarity} = \text{mass} \times \text{moles}$$

$$= 42.80g \times 0.2403M = 9.000M$$

9

$$e = m \times c \times \Delta T \quad \checkmark$$

$$8360 = 200 \times 4.18 \times 10 \quad \checkmark$$

4p

$$8360 = 100 \times c \times -125 \quad \checkmark$$

$$= \cancel{0.6688} J/g^{\circ}C \quad \checkmark$$

10a