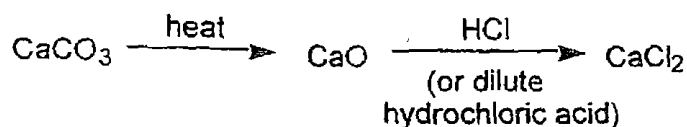


SPECIMEN MARK SCHEME

1. (a) (i)

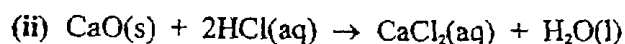


Correct formula for calcium carbonate [1 mark]

Other formulae correct and in right places [1 mark]

Correctly labelled arrows [1 mark]

[3 marks]



Correctly balanced equation [1 mark]

Correct state symbols [1 mark]

[2 marks]

(b) (i) $M_r \text{CaO} = 56$ [1 mark]

$$\frac{14.4}{56} = 0.257 \text{ moles CaO} \quad [1 \text{ mark}]$$

[2 marks]

(ii) 0.257 moles Ca [1 mark]

(iii) $\frac{0.257 \times 40}{50.0} \times 100 = 20.6\%$

Working [1 mark]

Answer [1 mark]

(Correct answer based on 'something over 50.0 multiplied by 100' scores

1 mark; correct answer with no working scores 2 marks.) [2 marks]

(c) Calcium and strontium are:

both in same group of Periodic Table [1 mark]

both have two electrons in outer shell [1 mark]

sum of first two ionisation energies [1 mark]

quite low [1 mark]

two electrons lost to form ion [1 mark]

Quality of written communication:

A minimum of two linked sentences making correct use of scientific terms such as *atom, ion, element, compound, ionisation, energy.*

[1 mark]

[6 marks]

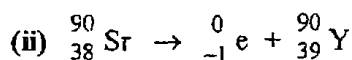
(d) (i) 38 protons

[1 mark]

52 neutrons

[1 mark]

[2 marks]



${}_{39}\text{Y}$

[1 mark]

Mass number of 90 for new element formed

[1 mark]

Rest of equation correct

[1 mark]

[3 marks]

(iii) $\{(84 \times 0.56) + (86 \times 9.86) + (87 \times 7.02) + (88 \times 82.56)\} / 100 = 87.7$

Correct working

[1 mark]

Answer in range 87 – 88

[1 mark]

correct

[1 mark]

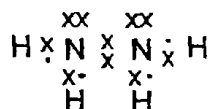
Correct sf (on reasonable answer)

[1 mark]

[4 marks]

Total 25 marks

2 (a) (i)



Lone pairs of electrons on nitrogens

[1 mark]

Single bond between nitrogens correctly shown

[1 mark]

Rest correct

[1 mark]

[3 marks]

(ii) Angle: $109^\circ (\pm 5)$

[1 mark]

Reasons: Four groups of electrons (or areas of electron density)

[1 mark]

Repel each other

[1 mark]

[3 marks]

(b)

(i)

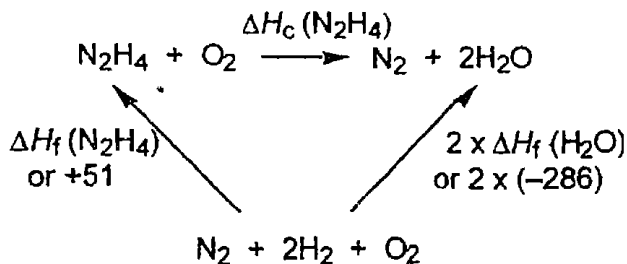


Diagram correct shape (elements, reactants, products)

[1 mark]

$\Delta H^\circ_f(\text{H}_2\text{O}) \times 2$ or -286 multiplied by 2

[1 mark]

Rest of detail correct

[1 mark]

[3 marks]

(ii) $\Delta H^\circ_c(\text{N}_2\text{H}_4) = 2 \times (-286) - 51$

[1 mark; allow *ecf* from diagram]

Correct answer with sign and units, -623 kJ mol^{-1}

[2 marks]

[2 marks]

(c) Amount in moles $\text{N}_2\text{H}_4 = 1000/32 (= 31.25)$

[1 mark]

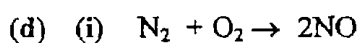
Amount in moles $\text{O}_2 =$ Amount in moles N_2H_4

[1 mark]

Volume $\text{O}_2 = (\text{moles } \text{N}_2\text{H}_4) \times 24 = 750 \text{ dm}^3$

[1 mark; includes correct answer (with *ecf*) and units]

[3 marks]



[1 mark]

(ii) Any one of the following:

toxic; (reacts to give NO_2 which causes) acid rain; greenhouse gas;
causes (photochemical) smog.

[1 mark]

(e) Gaseous hydrazine

more random arrangement/ more ways of arrangement

[1 mark]

of particles/molecules

[1 mark]

[2 marks]

Total 18 marks

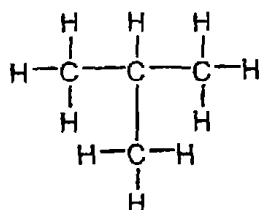
3. (a) Alkanes [1 mark]

(b) (i) Same molecular formula [1 mark]

Different arrangement [1 mark]

[2 marks]

(ii) Correct structure



[2 marks; 1 mark for an incorrect branched structure]

Name: Methylpropane

[1 mark]

[3 marks]

(c) H-C-H bond angle: 109° [1 mark]

Zig-zag carbon chain [1 mark]

Tetrahedral arrangement around a carbon atom [1 mark]

Rest of molecule correct [1 mark]

[4 marks]

(d) It is correct. [1 mark]

Bond enthalpies (or equivalent) are (approx) the same in different environments [1 mark]

Same bonds involved (or broken and made) in the combustion of both isomers [1 mark]

[3 marks]

(e) $C_4H_{10}(g) + 6.5O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)$ (or doubled)

Formulae correct [1 mark]

Balancing correct [1 mark]

State symbols [1 mark]

[3 marks]

(f) (i) A measure [1 mark]

of the tendency of the petrol to pre-ignite / autoignite [1 mark]

Higher the number, the less tendency (owtte) [1 mark]

[3 marks]

- (ii) It has a branched chain [1 mark]
- (g) It is a gas [1 mark]
 so a large tank is needed [1 mark]
- or
- It must be compressed [1 mark]
 which is difficult/expensive [1 mark]
- [2 marks]
- (h) (i) alcohol/hydroxy [1 mark]
 (ii) propan-1-ol [1 mark]
 (iii) ether [1 mark]
- (i) (i) Incomplete combustion [1 mark]
 of the fuel/hydrocarbons/butane [1 mark]
- [2 marks]
- (ii) It is toxic or poisonous or harmful to humans [1 mark]
- (j) (i) Reactants in different state from catalyst [1 mark]
 gas/solid [1 mark]
- [2 marks]
- (ii) 1. Reactants get adsorbed on to the catalyst surface.
 2. **Bonds break in reactants** [1 mark]
 3. New bonds form.
 4. **Product molecules released/diffuse away** [1 mark]
- [2 marks]
- (iii) Lead absorbed on surface [1 mark]
 instead of reactants [1 mark]
- [2 marks]
- Total 34 marks**

4. (a) Arrow upwards labelled 'electrons promoted' (owtte) [1 mark]
 Indication that only changes between energy levels allowed [1 mark]
 Energy absorbed related to (visible) frequency [1 mark]
 $E = hv$ [1 mark]
[4 marks]
- (b) (i) True, 23 and 24 [1 mark]
- (ii) True, 11 and 12/always true for two adjacent elements [1 mark]
- (iii) True, 2.8/two each [1 mark]
- (iv) False, different number of outer-shell electrons [1 mark]
 Na 1 outer electron, Mg 2 outer electrons [1 mark]
[2 marks]
- (c) (i) two nuclei/atoms [1 mark]
 merging/coming together [1 mark]
[2 marks]
- (ii) $2\text{}^1_6\text{C} \rightarrow \text{Na} + \text{}^1_1\text{H/p}$
- Atomic numbers of C and Na correct [1 mark]
 Hydrogen correct [1 mark]
[2 marks]
- Total 13 marks**