Mark Scheme for Specimen Paper
6241

1 (a) (i) $2s^2 2p^6 3s^2 3p^4$ **(1)** **[1]**

(ii) Protons = 16 **(1)** Neutron = 18**(1)** **[2]**

(b) (i)
- Energy change when 1 mole**(1)**
- Of gaseous atoms**(1)**
- Gains 1 electron per atom**(1)** **[3]**

(ii)
- Electron and anion both negative**(1)**
- Repulsion occurs**(1)** **[2]**

Total 8 marks

2. (a) (i) electron configuration or $3d^6 4s^2$ or $4s^2$
or number of **outer** electrons **(1)** **[1]**

(ii) atoms of the same element **(1)**that have different numbers of neutrons**(1)**
or
atoms with the same number of protons **(1)**but different numbers of neutrons**(1)** **[2]**

(b) (i) A ionisation (not vaporisation)**(1)**
B acceleration**(1)**
C deflection**(1)**
D detection**(1)** **[4]**

(ii) $\frac{(5.80 \times 54) + (91.6 \times 56) + (2.20 \times 57) + (0.40 \times 58)}{100}$ **(1)**

= 55.91**(1)** **[2]**

Total 9 marks

3 (a) (i) Mol of Ca used = 0.17/40 **(1)**
$= 4.25 \times 10^{-3}$
Volume of hydrogen produced = $4.25 \times 10^{-3} \times 24000$
= 102 cm^3 **(1)** **[2]**

(ii) $4.25 \times 10^{-3} \times 6.0 \times 10^{23}$ molecules
$= 2.55 \times 10^{21}$ **(1)** **[1]**

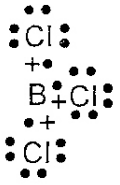
(b) Increases as group is descended**(1)** **[1]**

(c) (i) $Ca_{(g)} \rightarrow Ca_{(g)}^{+} + e^{-}$
1 mark for formulae and charges
1 mark for state symbols **[2]**

(ii)
- Decreases as group is descended**(1)**
- Because although there is an increase in nuclear charge**(1)**
- The electron being removed is further from the nucleus**(1)**
- And more shielded from the nuclear charge**(1)** **[4]**

Total 10 marks

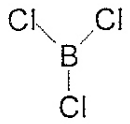
4 (a)



(1)

Must show all the outer electrons around the chlorine
Do not have to be • and +
(1) **[2]**

(b) (i)



(1) **[1]**

(ii) The (three) bonding (electron) pairs **(1)**
repel as far apart as possible / position of minimum repulsion **(1)** **[2]**

(c) (i) Power (of an atom) to attract (the pair of) electrons **(1)**
in a covalent bond / bonding pair **(1)**
n.b. could answer question by comparing the *electronegativities of the B and Cl* **[2]**

(ii) Bonds arranged symmetrically / molecule symmetrical / bond polarities directional / are vectors **(1)**
Bond polarities cancel **(1)**
Could be shown as a diagram **[2]**

Total 8 marks

5 (a) (i) H_2SO_4: +6 / VI **(1)**
H_2S: -2 **(1)**
SO_2: +4 / IV **(1)** **[3]**

(ii) Iodide has greater reducing power **(1)**
reduces sulphur by more oxidation numbers / or correctly uses their numbers from part (i) / or an 'electron gain' type argument **(1)** **[2]**

(b) (i) $2Cl^- \rightarrow Cl_2 + 2e^-$ or $Cl^- \rightarrow \frac{1}{2}Cl_2 + e^-$
or
$2Cl^- - 2e^- \rightarrow Cl_2$ **(1)** **[1]**

(ii) $OCl^- + 2H^+ + 2e^- \rightarrow Cl^- + H_2O$ **(2)**
Or $OCl^- + 2H^+ \rightarrow Cl^- + H_2O - 2e^-$
all species **1 mark**, balancing **1 mark** **[2]**

(iii) $OCl^- + 2H^+ + Cl^- \rightarrow Cl_2 + H_2O$ **(1)**
State symbols **(1)** **[2]**

Total 10 marks

6 (a) (i) Sodium has one outer electron that is delocalised into a sea of electrons others have more **(1)**.
Na^+ smallest charge/ ion comparison of the charges on the three ions **(1)**
Therefore weaker attraction between sodium cation and delocalised electrons hence lower melting temperature **(1)**

[3]

(ii) Both held by van der Waals forces that depends on the number of electrons **(1)**
P_4 has less than S_8 hence S_8 has a higher melting temperature. **(1)** **[2]**

(b) (i) *Structure* - giant or macro + atomic / molecular/ covalent **(1)**
Bonding - covalent **(1)** (ignore reference to vdW)
Diagram - layers **(1)**
of flat hexagons **(1)**
(min of 2 hexagons correctly joined for the *'hexagon' mark)* **[4]**

(ii) *Structure* – lattice / giant ionic / cubic (allow face centred cubic) **(1)**
Bonding - Ionic **(1)**
Diagram – lattice of alternate clearly identified / Na^+ and Cl^- ions, must imply 3-D. **(1)** **[3]**

(c) (i) Delocalised or sea of electrons between layers**(1)**
Which can flow/move **(1)** **[2]**

(ii) Ions (free to) move / mobile (in liquid state) **(1)** **[1]**

Total 15 marks

Paper total 60

Mark Scheme for Specimen Paper
6242

1 (a) (i) any **two** from
concentration
pressure
surface area / particle size **(2 x 1)** **[1]**

(ii) Pressure/ concentration:
Increase of pressure / concentration increases rate **(1)**
The particles are closer together therefore more collisions / more collisions per unit volume per unit of time **(1)**
Allow more 'frequent' collision
Or
Surface area:
Increase in surface area increase the rate **(1)**
More collisions on surface of solid /more surface available for collisions **(1)** **[2]**

(b) (i) Similar curve with peak further **to the right (1)**
and **lower** maximum**(1)** **[2]**
Max 1 mark if second line crosses the first more than once
or crosses axis

(ii) vertical line placed **to the right** of both of the peaks **(1)** **[1]**

(iii) (At higher temperature average kinetic) energy of molecules is greater **(1)**
More molecules / collisions have energy greater than / equal to the activation energy **(1)**
∴more collisions are effective/ result in reactions **(1)** **[3]**

Total marks 9

2 (a) Mr 2-bromobutane = 137 **(1)**
moles = 13.7/137 = 0.10 **(1)** allow 0.1
moles KOH = 9.0/56 = 0.16 (0.1607 or 0.161) **(1)**
KOH present in excess consequential **(1)** **[4]**

(b) lone pair donor / electron pair donor / lone or electron pair can form co-ordinate / dative bond **(1)**
hydroxide ion / OH^- **(1)** **2**

(c) rate increased **(1)**
C-I bond weaker (than C-Br bond) / lower bond energy **(1)** **2**

Total marks 8

3 (a) *Dynamic:*
reaction occurring in both directions / rate of forward reaction and reverse reactions equal **(1)**

Equilibrium:
constant concentrations / no change in macroscopic properties**(1)** **[2]**

(b) (i) Higher yield of ammonia / (equilibrium position) moves to. r.h.s **(1)**
Fewer product molecules **(1)** **[2]**

(ii) Lower yield of ammonia / (equilibrium position) moves to l.h.s.**(1)**
since this absorbs heat/ shift in endothermic direction / the reaction is exothermic**(1)** **[2]**

(c) (i) 350 - 500°C / 623 – 773K **(1)** **[1]**

(ii) High temp favours high rate **(1)**
Low temp favours good yield **(1)** } Or reverse argument
Temperature used of 350-500°C compromise / balance between yield and rate **(1)** **[3]**
consequential on first two points correct

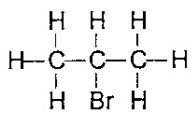
(d) (i) Iron (not Fe) **(1)** **[1]**
ignore references to oxides

(ii) Provides **alternative pathway** / route
or
Explanation of what happens at the surface**(1)**
of lower activation energy **(1)** **[2]**
Second mark consequential on the first

Total marks 13

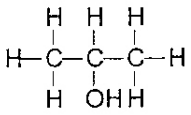
4 (a) (i) HBr (name or formula) **(1)**
gas phase or inert / organic solvent **(1)** **[2]**

(ii)



Or $CH_3CHBrCH_3$ **(1)** **[1]**

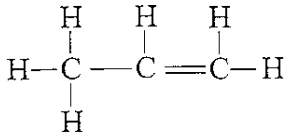
(b) (i)



Or $CH_3CH(OH)CH_3$ **(1)**
This mark is **not** consequential on (a)(ii) i.e. this is the only *acceptable answer* **[1]**

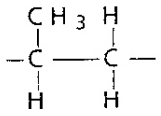
(ii) electrophilic**(1)** addition **(1)**
nucleophilic **(1)** substitution/ hydrolysis **(1)** **[4]**
All marks stand alone in this part of the question

(c) (i) Concentrated sulphuric acid / phosphoric acid / aluminium oxide **(1)**
Heat/ 170°C for sulphuric acid / 70 °C for phosphoric acid **(1)** **[2]**

(d)  **(1)** **[1]**

Total marks 11

5 (a) Group of compounds with the same general formula**(1)** that
differ by $-CH_2-$ **(1)**
Same or similar **chemical** properties / same functional group**(1)** **[3]**

(b) (i) 

At least one repeat unit and evidence of extension of chain**(1)** **[1]**

(c) Different chain lengths / areas of crystalline and amorphous structure **(1)** **[1]**

(d) (i) C-F bond strong/ high bond enthalpy/ bond not easily broken/ steric hindrance by fluorines around carbon**(1)** **[1]**

(ii) Non-stick coatings e.g. in saucepans, in pipes, on skis, stain-proofing of fabrics, waterproof clothing. **(1)** **[1]**

(e) **Only** single/ sigma bonds in ethane **(1)**
Allow saturated as an alternative to 'only', but types of bonds must also be mentioned
Ethene **also** has π bond **(1)**
π bond weaker (and breaks) / electrons in π bond more accessible **(1)** **[3]**

Total marks 10

6 (a) Enthalpy or heat change per mole **(1)**
For complete combustion **(1)**
At 1atm pressure and specified temperature **(1)** **[3]**

(b) (i) *Bonds broken:*
5C-H+C-O+O-H+3O=O = +4371 **(1)**
Bonds made:
4C=O + 6O-H = -5750 **(1)**
ΔH = +4371-5750 = -1379 kJ mol^{-1} **(1)**
[3]

(c) (ii) Exothermic **(1)**
Energy barrier **(1)** **[3]**
Fully labelled **(1)**

Total marks 9

Total for Paper 60

Mark Scheme for Specimen Paper
6243.02

1 (a) (i) Potassium / K^+ **(1)**
not K **[1]**

(ii) oxygen / O_2 **(1)**
KNO_3 / $KClO_3$ / KO_2 **(1)**
Do not allow K_2O **[2]**

(b) (i) carbon dioxide / CO_2 **(1)**
hydrogen / H^+ / H_3O^+ **(1)** **[2]**

(ii) barium sulphate / $BaSO_4$ **(1)**
sulphuric acid / H_2SO_4 **(1)** **[2]**

(c) Yellow / orange / brown *(not red alone)* **(1)**
to colourless / decolourised **(1)**

steamy fumes / steamy vapour / misty fumes **(1)**
litmus turns red **(1)** if candidates then go on to say the litmus is *bleached score zero for litmus test*

orange **(1)** to green **(1)** **[6]**

Total marks 13

2 (a) *Note* **1 mark** for improvement **1 mark** for related reason in each *case to* **max 4 marks.** Reason must relate to improvement. Max 2 *for improvement Max 2 for reason.*

Improvement	Insulate beaker/polystyrene cup/plastic cup/use lid **(1)**
Reason	Prevents/ reduces heat loss or absorbs less heat **(1)**
Improvement	Use pipette/ burette **(1)**
Reason	More accurate (than measuring cylinder) **(1)**
Improvement	Measure temperature for several minutes before the addition **(1)**
Reason	Allows more accurate value for the initial temperature **(1)**
Improvement	Measure temperature more often **(1)**
Reason	Allows for better extrapolation/ more accurate temperature change from graph **(1)**

Improvement Read thermometer to 1dp /use more precise thermometer/digital thermometer **(1)**

Reason Gives more accurate temperature change**(1)**

Improvement Stir mixture**(1)**

Reason Ensure even temperature/reaction faster less heat loss with time**(1)**

Improvement Use finely divided iron/smaller pieces **(1)**

Reason Reaction faster less heat loss with time **(1)**
not speeds up alone

[4]

(b) (i) Heat change = 50.0 x 4.18 x 15.2J**(1)**
= 50.0 x 4.18 x 15.2 / 1000kJ
= 3.18kJ or 3180J **(1)**
Ignore sig. fig. Allow 1 mark for correct answer with no *working* **[2]**

(ii) No of mols of copper sulphate = 50.0 x 0.500 / 1000
= 0.025 **(1)** **1**

(iii) Enthalpy change per mol = 3.18/.025 = -127kJ**(1)**
negative sign **(1)**stand alone
consequential on (i) and (ii)
max 4 sig fig and answer must be in kJ mol^{-1} even if units omitted. **2**

Total marks 9

3 (a) diagram 1 (heating under) reflux **(1)**
diagram 2 distillation **(1)** allow fractional distillation **[2]**

(b) (i) reaction is slow / time needed for reaction to reach completion **(1)** **[1]**

(ii) condenses vapours and returns liquid to flask / vapour turns to liquid and returns to flask**(1)**
(it allows reaction at boiling point of reactants) without loss / escape of material/reactants
prevents loss/escape of materials/reactants/products **(1)** **[2]**

(c) heat the mixture (slowly) **(1)**
collect **only** fraction/distillate **(1)**
produced at 102 °C / around 102 °C / between 100 -104 °C **(1)**
Need to make clear that only distillate at this temperature is *collected e.g. rest discarded for second mark* **[3]**

(d) (i) 3.1 **(1)** x 100 = 43.1% **(1)** Allow 2-4 significant figures

7.2 [2]

(ii) two reasons from:
side reactions **(1)**
reaction incomplete **(1)**
product lost in purification / transfers **(1)**
max [2]

(b) (i) AgBr **(1)** **[1]**

(ii) $CH_4H_9Br + H_2O \rightarrow C_4H_9OH + H^+ + Br^-$

$CH_3CH_2CH_2CH_2Br + H_2O \rightarrow CH_3CH_2CH_2CH_2OH + H^+ + Br^-$
OH^- $+ Br^-$ **(1)** **[1]**

(iii) Reaction very slow at room temperature / heat speeds up the reaction /increases rate / flammable **(1)** **[1]**
Do not allow constant temp.

Total marks 15

4 (a) (i) $\frac{0.25}{97} = 0.00258 / 2.58 \times 10^{-3} / 0.0026 / 0.002577$ **(1)** **[1]**

(ii) 0.00258 / *same number of moles as calculated in (i)* **(1)**

$0.00258 \times \frac{1000}{23.45}$ **(1)** $= 0.110$ (mol dm^{-3}) **(1)** units not required
consequential on (i) **[3]**

(b) $\frac{2 \times 0.01 \times 100}{0.25} = 8\%$ **(1)** **[1]**

(c)

W	Weighing	must be evidence of two weightings at some point in the process **(1)**	
P	Preparation	Rinsing out one piece of relevant apparatus correctly **(1)**	**Max 5 marks**
D	Dissolve	Dissolve in water in beaker / volumetric flask **(1)**	
R	Rinse	Rinse beaker and add washing to volumetric flask / rinse funnel (if solid straight to volumetric flask) **(1)**	
V	Volumetric flask	Volumetric / standard / graduated flask **(1)** DO NOT AWARD IF CANDIDATE USES VOLUMETRIC FLASK TO MEASURE OUT 250 cm^3	
M	250 cm^3	Making up to mark / exactly 250 cm^3 of solution **(1)**	
S	Shake	Shake / invert / mix final solution **(1)** n.b. this is at end	

C concentration = $\frac{\text{mass of sulphamic acid}}{97 \text{ (or Mr)}} \times \frac{1000}{250}$ **(1)**

H Safety
(solution of) acid is corrosive wear gloves **(1)**

8

Total marks 13

PAPER TOTAL 50 MARKS