M1. (a) decreases

1

number of shells increases/ shielding increases /atomic size increases

weaker attraction (by nucleus) on bonding electrons / weaker attraction (by nucleus)

1

on electron pair in a covalent bond

1

(b) (i) increases

1

(ii) concentrated sulphuric acid

1

(c) white ppt

1

soluble in ammonia

1

cream ppt

1

partially soluble /insoluble in ammonia

1

(d) $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$

1

bleach

1

disinfectant /steriliser/kills bacteria

1

[12]

M2. (a) (i) HNO_3 or CH_3COOH **(1)**

CE in (a) if incorrect acid given

(ii) $2HNO_3 + Na_2CO_3 \rightarrow 2NaNO_3 + CO_2 + H_2O$ **(1)**
OR $2H^+ + CO_3^{2-} \rightarrow H_2O + CO_2$
Not H_2CO_3

2

(b) (i) I^- or At^- not elements, atoms or molecules **(1)**

(ii) F^- not elements, atoms or molecules **(1)**

2

(c) (i) Cl^- **(1)**

Allow AgCl Not element, atoms or molecules

(ii) Br^- **(1)**

Allow AgBr Not element, atoms or molecules

2

[6]

M3.(a) increases from fluorine to iodine **(1)**

sizes of molecules increase **(1)**
(or <u>molecules</u> have more electrons or mass of <u>molecules</u> increases)

QoL mark

Magnitude of intermolecular forces or vdW forces increase **(1)** (or more vdW forces)

More energy required to separate molecules (or particles) **(1)**
(or more energy to break intermolecular forces)
or intermolecular forces difficult to break

4

(b) with NaCl white ppt **(1)**
soluble in ammonia **(1)**

note, if ppt <u>clearly</u> refers to wrong substance
e.g. NaCl then C.E = 0

with NaBr cream (or off white or biege) ppt **(1)**
partially soluble (or insoluble) in ammonia **(1)**

ignore references to conc ammonia

if obviously added silver nitrate mixed with ammonia allow:
*NaCl: no change **(2)***
*NaBr: cream ppt **(2)***

4

(c) oxidising ability decreases from chlorine to iodine (or down the Group) **(1)**

$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$ **(1)**
allow use of NaBr, HBr etc

Br_2 red brown (or yellow or orange) liquid (or solution but not solid) **(1)**

$Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ **(1)**
allow use of NaBr etc, penalise HI once only

I_2 brown solution / black solid **(1)**
do not allow any reference to purple

$Br_2 + 2I^- \rightarrow 2Br^- + I_2$ **(1)**

Yellow/orange/red-brown/brown solution goes brown/darker brown solution/black solid **(1)**

7

[15]

M4. (a) decreases;

1

increase in shielding ;

1

(or atomic radius)
less attraction for bonding *(or shared)* electrons;

1

(b) brown solution;

1

(or black solid)
$Cl_2 + 2KI \rightarrow 2KCl + I_2$;

(or ionic equation)

1

(c) SO_2;

1

$SO_4^{2-} + 4H^+ 2e^- \rightarrow SO_2 + 2H_2O$;

1

S (also H_2S);

1

$SO_4^{2-} + 8H^+ 6e^- \rightarrow S + 4H_2O$ (or $SO_4^{2-} + 10H^+ + 6e^- \rightarrow H_2S + 4H_2O$)

1

(d) $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$;

1

sodium chloride;

1

–1;

1

sodium chlorate(I) (or bleach etc);

1

+1;

1

[14]

M5.(a) Increase

1

Van der Waal's forces between molecules

1

Increase with size (or M_r or surface area etc)

1

More energy needed to break (overcome) these forces

(Note max 2 from last three marks if no mention of molecules or 'molecular')

1

(b) (i) Brown solution (or yellow or orange)

1

$Cl_2 + 2Br \rightarrow 2C1^- + Br_2$

1

(ii) cream precipitate

1

$Br^- + Ag^+ \rightarrow AgBr$

1

Precipitate dissolves

1

(iii) orange (brown) fumes (gas), White fumes (or misty fumes), choking gas (any 2)

2

(c) $2H^+ + H_2SO_4 + 2Br^- \rightarrow SO_2 + Br_2 + 2H_2O$ (SO_2 and Br_2 (1), equation (1))

2

[13]