1 **(a) (i)** $Ca^{2+} + 2F \rightarrow CaF_2$ [2]
Not balanced **ONLY** [1]
Both species must be correct for first mark. Second mark is for correct balancing.

(ii) Mole ratio Ca^{2+}: F is 1:2 [1]
Answer must mention moles
accept argument based on charges or number of ions
accept 2 moles of NaF react with 1 mole of $CaCl_2$
NOT just "2" in equation
If fluorine must specify atoms or ions

(iii) to remove traces of solutions **or** to remove soluble impurities **or** to remove a named salt sodium chloride **or** sodium fluoride **or** calcium chloride [1]
To remove impurities is not enough

(iv) to dry (precipitate) **or** to remove water **or** to evaporate water [1]
NOT to evaporate some of water **NOT** to crystallise salt

(b) $T_3(PO_4)_2$ allow correct example [1]
explain why 8 cm^3 react fully [1]
comment about mole ratio [1]

[Total: 8]

2 (a) pH < 7 [1]
example [1]

pH > 7 [1]
example [1]
NOT amphoteric oxides Be, A*l*, Zn, Pb, Sn etc

pH = 7 [1]
example H_2O, CO, NO [1]
the two marks are not linked, mark each independently
NOT amphoteric oxides Be, A*l*, Zn, Pb, Sn etc.

(b) (i) shows both basic and acidic properties [1]

(ii) a named strong acid [1]
a named alkali [1]

[Total: 9]

3 **(a)** magnesium + sulphuric acid = magnesium sulphate + hydrogen [1]
ACCEPT hydrogen sulphate

(ii) $Li_2O + H_2SO_4 \rightarrow Li_2SO_4 + H_2O$ [2
formulae correct but not balanced [1]

(iii) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$ [2
OR $CuO + 2HCl \rightarrow CuCl_2 + H_2O$
OR $CuO + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O$
formulae correct but not balanced [1]

(iv) sodium carbonate + sulphuric acid → sodium sulphate + carbon dioxide + water [1]

(b) it <u>accepts a proton</u> [2]
it accepts a hydrogen ion [1] **ONLY**

(c) sulphuric acid is completely ionised [1]
or few molecules and many ions
ethanoic acid is partially ionised [1]
or many molecules and few ions

[Total: 10]

4 **(i)** method C [1]
sulphuric acid (allow if given in equation) [1]
zinc oxide + sulphuric acid = zinc sulphate + water [1]

(ii) method A [1]
hydrochloric acid [1]
$KOH + HCl = KCl + H_2O$ [1

(iii) method B [1]
potassium iodide **or** any soluble iodide [1]
$Pb^{2+} + 2I = PbI_2$ accept a correct equation even if soluble iodide is wrong [2]
Not balanced - $Pb^{2+} + I = PbI_2$ ONLY [1]

[Total: 10]

5 **(a)** **(i)** equilibrium to left **or** many molecules and few ions **or**
partially ionised **or** reverse reaction favoured [1]

(ii) Water donates <u>proton</u> [1]
methylamine accepts a proton [1]
NOTE If hydrogen ion then **ONLY** [1] provided both are correct

(b) less than 12 more than 7 [1]
smaller <u>concentration</u> of hydroxide ions **or** partially dissociated **or**
poor proton acceptor **or** poor H^+ acceptor [1]
NOT it is a weak base

(c) **(i)** $CH_3NH_2 + HCl = CH_3NH_3Cl$ [1]
methylammonium chloride [1]
NOTE the equation must be as written, the equation with sulphuric acid has been given as guidance.

(ii) brown precipitate [1]
ACCEPT orange **or** red/brown **or** brick red **or** brown/red

(iii) sodium hydroxide **or** any <u>named</u> strong base [1]

[Total: 9]

6 **(a)** ammonia 10
hydrochloric acid 1
sodium hydroxide 13
ethanoic acid 4
All correct **[2]**
Two correct [1]

(b) With strong acid bulb brighter **[1]**
faster rate of bubbles **[1]**
OR corresponding comments for weak acid

(c) proton **NOT** hydrogen ion **[1]**
H^+ not conditional on proton **[1]**
Only way for [2] is proton and H^+

(d) CaO and MgO **[1]**

(ii) CO_2 and SO_2 **[1]**

(iii) Al_2O_3 **[1]**

(iv) CO **[1]**

[TOTAL = 10]