

Further analysis and quantitative chemistry

1. Any series of chemical tests that work should be given credit

each mark is for test + result + inference

identifying all 4 substances unambiguously with no errors gains **5** marks

e.g.

• Flame test: yellow / orange \Rightarrow Na^+ \Rightarrow sodium sulphate 1
ignore incorrect flame test colours for other compounds

• Add NaOH to remaining 3 samples: no (white) ppt / ammonia \Rightarrow 1
no need to test for ammonia

NH_4^+ \Rightarrow ammonium sulphate(white) ppt \Rightarrow magnesium ions or aluminium ions 1

• add excess NaOH to the 2 samples which gave a (white) ppt:
ppt dissolves \Rightarrow aluminium sulphate 1
ppt insoluble \Rightarrow magnesium sulphate 1

or

• Add NaOH:
no ppt: ammonia \Rightarrow NH_4^+ \Rightarrow (1)
ammonium sulphate
the other one is sodium sulphate (1)
(damp red) litmus goes blue*
 \Rightarrow NH_3 \Rightarrow ammonium sulphate
the other one is sodium sulphate

• Add excess NaOH to the 2 samples which gave the white ppt (1)
ppt dissolves \Rightarrow aluminium sulphate (1)
ppt insoluble \Rightarrow magnesium sulphate (1)
() or UI/pH indicator goes blue/purple*

[5]

2. (a) **must** be description of a titration no titration = no marks

NaOH in burette 1
*do **not** accept biuret etc*

add NaOH until (indicator) changes colour 1
*if specific colour change mentioned, must be correct – colourless to pink / red **or** 'goes pink / red'*
*do **not** accept 'clear' for colourless*

note (burette) volume used **or** final reading 1
accept 'work out the volume'

one other point: eg repeat 1
*accept:(white) tile **or** add dropwise / slowly **or** white background **or** swirling / mix **or** read meniscus at eye level **or** wash apparatus*

- (b) 0.054 2
for 2 marks
(0.1 × 13.5)/25 for 1 mark
- (c) don't know – insufficient evidence to decide *owtte*
any sensible answer
- or** depends on whether acid level is considered safe or unsafe
 yes, safe – acid level low / weak acids / low compared with stomach acid *owtte*
any sensible answer
- no, unsafe – acid level (too) high / other substances or bacteria may be present
 / insufficient evidence to decide *owtte* 1
any sensible answer
- (d) (methyl orange) would have changed colour (well) before the end-point
 / pH7 / neutral *owtte* 1
- weak acid present 1
weak acid-strong base (titration)
allow methyl orange used for strong acid-weak base titration

[9]

3. (a) (i) e.g. moles NaOH = moles of acid
or formula:
- $$0.2 \times \frac{45}{1000} = 0.009$$
- 15M₁ = 0.2 × 45*
- rounding to 0.01 loses mark
- $$= 0.009 \times \frac{1000}{15} = 0.6(M)$$
- M₁ = 0.6(M)*
- e cf for arithmetical error
correct answer 2 marks
- (ii) 36 2
e cf – (a)(i) × 60
correct answer 2 marks
0.6 × 60 gets 1 mark
relative formula mass of ethanoic acid
= 60 for 1 mark
0.6 × incorrect molar mass gains second mark only
- (b) (i) A = hydrogen / H₂ 1
 B = sodium hydroxide / NaOH **or** sodium oxide / Na₂O 1
- (iii) C = ethyl ethanoate (acetate) / CH₃COOC₂H₅ / CH₃CO₂C₂H₅ 1
- (iv) D = (concentrated) sulphuric acid /H₂SO₄ 1
do not accept dilute sulphuric acid
- E = sodium ethanoate (acetate) / CH₃COONa / CH₃CO₂Na 1

[9]