OCR A-Level Chemistry A

Acids and redox reactions mark scheme · goes with “Acids and redox reactions” · whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/

Mark schemes

Acids and redox reactions · 10 questions

Q1 · June 2019 · AS Paper 1 (Breadth in chemistry) · Q22 · [7 marks]

OCR MARK SCHEME

22(a)(i)

Titre/cm^3	24.20	23.85	24.30	✓

Correct subtractions to obtain titres to 2 DP

[1 mark]

22(a)(ii)

mean titre = $\frac{24.20 + 24.30}{2}$ = 24.25 (cm^3) ✓

i.e. using concordant (consistent) titres

[1 mark]

22(b)

FIRST CHECK THE ANSWER ON ANSWER LINE

IF answer = 0.309 (mol dm^{-3}) award 3 marks

$n(Na_2CO_3)$

= 0.150 × $\frac{25.00}{1000}$ = 3.75×10^{-3} (mol) ✓

n(HCl)

= 2 × $n(Na_2CO_3)$ = 7.50×10^{-3} (mol) ✓

[HCl] to 3 SF

= n(HCl) × $\frac{1000}{\text{mean titre from b(i)}}$

= $7.50 \times 10^{-3} \times \frac{1000}{24.25}$ = 0.309 (mol dm^{-3}) ✓

EXAMINER GUIDANCE

DO NOT ALLOW *24.2* ***OR*** *24.3*

DO NOT ALLOW *mean of all three titres,*

i.e. $\frac{24.20 + 23.85 + 24.30}{3}$ = 24.10/24.12

ALLOW ECF *from incorrect concordant titres from 22a(i)*

ALLOW 3SF *or more throughout*

IGNORE *trailing zeroes,*

e.g. **ALLOW** 0.075 for 0.00750

ALLOW ECF *from 2 × incorrect $n(Na_2CO_3)$*

ALLOW ECF *from incorrect n(HCl),*

OR from $n(Na_2CO_3)$ if n(HCl) stage omitted

ALLOW ECF *from incorrect mean titre in b(ii)*

COMMON ERROR for 3 marks

3 SF required

[3 marks]

From 24.10 cm^3 (mean of all 3 titres in b(ii)), [HCl] = 0.311 (mol dm^{-3})

22(c)

Pipette:

$\frac{0.04}{25.0} \times 100 = 0.16$ **OR** 0.2 (%) ✓

Burette: (using any of 3 titres or mean titre), e.g.

$\frac{0.05 \times 2}{24.20} \times 100 = 0.41$ **OR** 0.4 (%) ✓

Response does **NOT** need a statement of whether pipette or burette has greater % uncertainty.

[2 marks]

ALLOW *% uncertainties to 1 SF or more, rounded correctly*

Other burette volumes:

$\frac{0.05 \times 2}{23.85} \times 100 = 0.42$ **OR** 0.4 (%)

$\frac{0.05 \times 2}{24.30} \times 100 = 0.41$ **OR** 0.4 (%)

$\frac{0.05 \times 2}{24.25} \times 100 = 0.41$ **OR** 0.4 (%)

ALLOW burette volume of 50 cm^3, i.e.

$\frac{0.05 \times 2}{50} \times 100 = 0.2\%$

ALLOW ECF *from incorrect titre in 22(a)*

IF BOTH *calculations are 'correct' but ×100 is omitted BOTH times,* ***ALLOW*** *1 mark*

Q2 · June 2023 · AS Paper 1 (Breadth in chemistry) · Q22 · [11 marks]

OCR MARK SCHEME EXAMINER GUIDANCE

22(a)

(Strong acid) completely/fully dissociates/ionises ✓

[1 mark]

DO NOT ALLOW *easily dissociates*

ALLOW ALL H^+ ions are released

22(b)(i)

$CuO + 2HCl \rightarrow CuCl_2 + H_2O$ ✓

[1 mark]

ALLOW multiples

IGNORE *state symbols*

IGNORE *charges, even if wrong*

22(b)(ii)

$(NH_4)_2CO_3 + 2HNO_3 \rightarrow 2NH_4NO_3 + CO_2 + H_2O$

Any 4 formulae correct ✓

All 5 formulae correct and balanced ✓

[2 marks]

ALLOW multiples

IGNORE *state symbols*

IGNORE *charges, even if wrong*

ALLOW H_2CO_3 for $CO_2 + H_2O$

Counts as 2 formulae for marking criteria

22(c)(i)

Volumetric flask ✓

[1 mark]

ALLOW graduated flask

22(c)(ii)

Shaded cells were given in the question.

Final reading/cm^3	20.25	40.85	25.85
Initial reading/cm^3	0.00	20.25	5.50
Titre/cm^3	**20.25**	**20.60**	**20.35**

All 3 titres correct to 2 DP ✓

[1 mark]

DO NOT ALLOW *1 DP, e.g. 20.6 instead of 20.60*

22(c)(iii)

mean titre = $\frac{20.25 + 20.35}{2}$ = 20.30 (cm^3) ✓

i.e. using concordant (consistent) titres

[1 mark]

ALLOW 20.3

Missing '0' already penalised in c(ii)

DO NOT ALLOW *mean of all three titres,*

i.e. $\frac{20.25 + 20.60 + 20.35}{3}$ = 20.40

22(c)(iv)

ALLOW ECF *throughout and from incorrect concordant titres from*

$n(H_2SO_4) = 0.165 \times \frac{20.30}{1000} = 3.35 \times 10^{-3}$ (mol) ✓

n(MOH) in 25.0 $cm^3 = 2 \times 3.35 \times 10^{-3}$

$= 6.70 \times 10^{-3}$ (mol) ✓

n(MOH) in 250.0 $cm^3 = 10 \times 6.70 \times 10^{-3}$

$= 6.70 \times 10^{-2}$ (mol) ✓

A_r of M = $\frac{2.62}{6.70 \times 10^{-2}}$ = 39.1 AND M = potassium/K ✓

COMMON ERRORS

Use of 20.4 from mean of all 3 titres ALL 4 MARKS

$n(H_2SO_4) = 0.165 \times \frac{20.4}{1000} = 3.366 \times 10^{-3}$ (mol) ✓ from (c)

(iii)

n(MOH) in 25.0 $cm^3 = 2 \times 3.366 \times 10^{-3}$

$= 6.732 \times 10^{-3}$ (mol) ✓

n(MOH) in 250.0 $cm^3 = 10 \times 6.732 \times 10^{-3}$

$= 6.732 \times 10^{-2}$ (mol) ✓

A_r of M = $\frac{2.62}{6.732 \times 10^{-2}}$ = 38.9.... **OR** 39 AND M = K ✓

***IF** ×10 is absent, A_r = 389 AND M = Cs **OR** Fr*

Use of 25.0 (wrong volume) for $n(H_2SO_4)$

$n(H_2SO_4) = 0.165 \times \frac{25}{1000} = 4.125 \times 10^{-3}$ (mol) ✗

n(MOH) in 25.0 $cm^3 = 2 \times 4.125 \times 10^{-3}$

$= 8.25 \times 10^{-3}$ (mol) ✓

n(MOH) in 250.0 $cm^3 = 10 \times 8.25 \times 10^{-3}$

$= 8.25 \times 10^{-2}$ (mol) ✓

A_r of M = $\frac{2.62}{8.25 \times 10^{-2}}$ = 31.75..... AND M = K ✓

***IF** ×10 is absent, A_r = 317.5 AND M = Cs **OR** Fr*

22c(iii)

Calculator value = 3.3495×10^{-3}

Calculator value = 6.699×10^{-3}

Calculator value = 6.699×10^{-2}

By **ECF**, ALLOW Group 1 metal nearest to calculated value of A_r

[4 marks]

Q3 · June 2023 · AS Paper 1 (Breadth in chemistry) · Q5 · [1 mark]

Answer: **B**

S_8

Q4 · June 2024 · AS Paper 1 (Breadth in chemistry) · Q22 · [8 marks]

OCR MARK SCHEME

22(a)

strong acid: fully dissociates/ionises

AND

weak acid: partially dissociates/ionises ✓

[1 mark]

EXAMINER GUIDANCE

ALLOW strong acid fully dissociates

weak acid dissociates/ionises less

ALLOW strong acid releases all H^+ ions

weak acid partially releases H^+ ions

IGNORE strong acid dissociates more

strong acid dissociates quicker

DO NOT ALLOW

strong acid fully dissociates

weak acid does not fully dissociate

Response does not state that weak acid dissociates

IGNORE breaks down for dissociate/ionise

DO NOT ALLOW *comparison of concentrations*

22(b)(i)

Titre/cm^3	24.40	24.15	24.25	✓

Correct subtractions to obtain titres to 2 DP

[1 mark]

DO NOT ALLOW *24.4*

22(b)(ii)

mean titre = $\frac{24.15 + 24.25}{2}$ = 24.20 (cm^3) ✓

i.e. using concordant (consistent) titres

[1 mark]

ALLOW 24.2 DP already assessed in b(i)

DO NOT ALLOW *mean of all three titres,*

i.e. $\frac{24.40 + 24.15 + 24.25}{3}$ =

24.26/24.27

ALLOW ECF *from incorrect concordant titres from 22b(i)*

22(b)(iii)

ALLOW 3SF or more throughout

FIRST CHECK ANSWER ON ANSWER LINE

IF answer = 89.4 (%) award 5 marks

CHECK mean titre from 22b(ii) first.

THEN apply **ECF** throughout using THIS mean titre

First 3 mark must come from the titration

$n(Na_2CO_3) = 0.200 \times \frac{24.20}{1000} = 4.84 \times 10^{-3}$ (mol) ✓

$n(CH_3COOH)$ in 25.0 $cm^3 = 2 \times 4.84 \times 10^{-3} =$

9.68×10^{-3} (mol) ✓

$n(CH_3COOH)$ in 250 $cm^3 = 10 \times 9.68 \times 10^{-3} =$

9.68×10^{-2} (mol) ✓

mass of CH_3COOH) in 250 $cm^3 = 60 \times 9.68 \times 10^{-2} = 5.808$ (g) ✓

% composition to 3 SF = $\frac{5.808}{6.50} \times 100 = 89.4$ (%) ✓ 3 SF

Calculator: 89.35384615

COMMON ERRORS

Omitting ÷ 1000 for $n(Na_2CO_3)$

Up to 3 marks are possible

$n(Na_2CO_3) = 0.200 \times 24.20 = 4.84$ (mol) ✗

$n(CH_3COOH)$ in 25.0 $cm^3 = 2 \times 4.84 = 9.68$ (mol) ✓

$n(CH_3COOH)$ in 250 $cm^3 = 10 \times 9.68 = 96.8$ (mol) ✓

mass of CH_3COOH) in 250 $cm^3 = 60 \times 96.8 = 5808$ (g) ✓

% composition to 3 SF = $\frac{5808}{6.50} \times 100 = 89400$ (%) ✗

Impossible value

[5 marks]

IGNORE trailing zeroes,

e.g. ALLOW 24.2 for 24.20

***ALLOW ECF** from incorrect mean titre in b(ii)*

***ALLOW ECF** from 2 × incorrect $n(Na_2CO_3)$*

***ALLOW ECF** from incorrect $n(CH_3COOH)$,*

OR

from $n(Na_2CO_3)$ if $n(CH_3COOH)$ stage omitted

ALLOW 5.81 (3 SF)

IF mass is rounded to 5.81, Answer is still 89.4%

Calculator = 89.38461538

8.94% is 4 marks (omission of × 10 stage)

IF incorrect mean titre of 24.26/24.27 cm^3 used:

(mean of all 3 titres in b(ii)),

% composition = 89.6% to 3 SF for ALL 5 marks by **ECF**

***NOTE**: Some candidates are calculating $n(CH_3COOH)$ based on the 6.50 g sample being pure*

***DO NOT ALLOW** 0.108(3.....*

$n(CH_3COOH) = \frac{6.50}{60} = 0.108(3.....$

COMMON ERRORS

Using 25.0 cm^3 (pipette volume) instead of 24.20 cm^3

Up to 4 marks are possible

$n(Na_2CO_3) = 0.200 \times \frac{25.00}{1000} = 5.00 \times 10^{-3}$ (mol) ✗

$n(CH_3COOH)$ in 25.0 $cm^3 = 2 \times 5.00 \times 10^{-3} = 1 \times 10^{-2}$ (mol) ✓

$n(CH_3COOH)$ in 250 cm^3 = 10 × $1 \times 10^{-2} = 1 \times 10^{-1}$ (mol) ✓

mass of CH_3COOH) in 250 cm^3 = 60 × 1×10^{-1} = 6.00 (g) ✓

% composition to 3 SF

$= \frac{6.00}{6.50} \times 100 = 92.3$ (%) ✓

Calculator: 92.30769231

Q5 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q1 · [1 mark]

Answer: **D**

0.55%

Q6 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q6 · [1 mark]

Answer: **C**

OCR MARK SCHEME

+2

EXAMINER GUIDANCE

ALLOW +2

Q7 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q7 · [1 mark]

Answer: **B**

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

Q8 · June 2025 · AS Paper 2 (Depth in chemistry) · Q3 · [11 marks]

OCR MARK SCHEME

3(a)(i)

23.30	**23.05**	**23.15**

✓

[1 mark]

EXAMINER GUIDANCE

DO NOT ALLOW *23.3*

3(a)(ii)

Mean titre = $\frac{23.05 + 23.15}{2}$ = 23.1(0) ✓

[1 mark]

ALLOW ECF *from incorrect titres from 3a(i) but values must be concordant (i.e. within 0.1 cm^3 of each other)*

3(a)(iii)

FIRST CHECK THE ANSWER ON THE ANSWER LINE

If answer = 413 (mg) award 5 marks

ALLOW ECF *from incorrect mean titre in a(ii) and throughout*

$n(NaOH) = \frac{23.1 \times 0.08}{1000} = 1.848 \times 10^{-3}$ ✓

$n(acid) \text{ in } 25\ cm^3 = \frac{1.848 \times 10^{-3}}{2} = 9.24 \times 10^{-4}$ ✓

$n(acid) \text{ in } 250\ cm^3 \text{ for 3 tablets} = 9.24 \times 10^{-4} \times 10$

$= 9.24 \times 10^{-3}$ ✓

mass of acid in 3 tablets = $9.24 \times 10^{-3} \times 134$

= 1.23(816) g ✓

$\text{mass of acid in one tablet} = \frac{1.23816 \times 1000}{3} = 413$ (mg) ✓

[5 marks]

ALLOW *3SF up to calculator value throughout*

TAKE CARE: values shown may be truncated calculator values.

IGNORE *rounding errors past 3SF*

Steps can be calculated in any order which will change the intermediate answers. Marks are for the processing of the data.

Alternative Approach

n(acid) in one tablet

$= \frac{9.24 \times 10^{-3}}{3} = 3.08 \times 10^{-3}$ ✓

mass of acid in one tablet =

$3.08 \times 10^{-3} \times 134 \times 1000$

= 413 (mg) ✓

Final answer must be to 3 SF **AND** mg

COMMON ERRORS

0.413, 4.13, 41.3	4 marks	Incorrect conversion to mg **(check for x 10 in method)**
1240 / 1238	4 marks	Not divided by 3 for 1 tablet

3(b)

The titre would be greater ✓

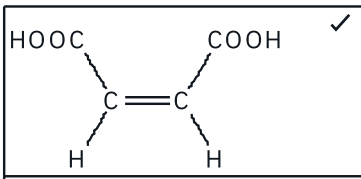
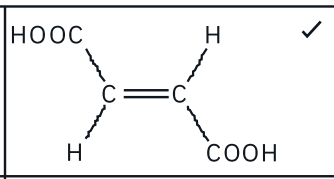
(NaOH) would be more dilute / less concentrated (so a bigger volume would be needed to neutralise the acid). ✓

[2 marks]

ALLOW *AW*

3(c)

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

 ✓	 ✓
cis	*trans*

[2 marks]

ALLOW *one mark if both stereoisomers of are shown but in the incorrect columns*

DO NOT ALLOW *incorrect connectivity e.g.*



or - HOOC on first occasion but allow **ECF** in second structure.

Q9 · June 2025 · Paper 1 (Periodic table, elements and physical chemistry) · Q4 · [1 mark]

Answer: **A**

5.75

Q10 · June 2025 · Paper 1 (Periodic table, elements and physical chemistry) · Q8 · [1 mark]

Answer: **D**

0.37%

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