SERIES 19 EXAMS

CHEMISTRY 231/3
MARKING SCHEME
Procedure I

Table 1

	I	II	III
Final burette reading (cm^3)	24.0	48.0	24.0
Initial burette reading (cm^3)	0.0	24.0	0.0
Titre volume (cm^3)	24.0	24.0	24.0

CT-1mk
D.P=1mk
AC-1mk
P.A=1mk
F.A=1mk

Awarding /distribution of marks:

(a) Complete table (C.T)-1mk

Conditions

(i) Complete table with 3 titrations -1mk

(ii) Incomplete table with 2 titrations .. ½ mk

(iii) Incomplete table with 1 titration …0mk

Penalties

(i) Wrong arithmetic

(ii) Inverted table

(iii) Where burette readings are beyond 50 and unexplained

(iv) Unrealiastic titre readings (values) i.e below 1.0cm^3 or hundreds

(Penalize ½ mk each to maximum of ½ mk /penalize once for any of the above mistakes)

(b) Use of decimals (d.p) 1mk

Tied to the first and second row only

Conditions

(i) accept aither 1 or 2 d.p used consistently, otherwise penalize fully

(ii) If the 2nd D.P is used, then it should be either '0' or '5'

Accept inconsistency in the use of zeros used as initial burette readings e.g 0.0,0,00.00,0.000

© Accuracy (Tied to the correct titre value)……1mk

Compare the candidates titre value with the school value and award marks as follows

(i) If atleast one titre value is within ±0.1 of the schools value (SV>) …..1mk

(ii) If none of the titre values within ±0.2 of SV…….. ½ mk

(iii) If none is within ± 0.2 of S.V……0mk

(Tick the value that awards for the accuracy (AC) mark from the table)

N/B

(i) If there is wrong arithmetic/no subtraction in the table, compare the WORKED OUT correct value with the S,V and award accordingly.

(ii) Where there are two possible school values from the teachers results, indicate both values on the script and use the one closer to the candidates values to award accuracy and final accuracy

(iii) If no S.V is given or cannot be worked out from the teachers titre values as per the principles of averaging, then:

(a) All the candidates correct average titre values should be written down and close values picked for averaging per session

(b) If the candidates values are varied, ignore them and use the values in the marking scheme ($24.0cm^3$)

(d)Principles of averaging (P.A) …….1mk

Conditions

(i) If 3 consistent values are all averaged……..1mk

(ii) If 3 titrations are done, but only 2 are consistence and averaged ……1mk

(iii) If only 2 titrations are done and are consistent and averaged …1mk

(iv) If 3 titrations are done, and ALL can be averaged, but only two are averaged…….(0mk)

(vi) If only 2 titrations done, inconsistent and averaged ….0mk

(vii) If any 1 titrations done,…….0mk

Penalties

(i) Penalize ½ mk for wrong arithmetic if error is outside ± units in the 2^{nd} decimal place (on the answer)

(ii) Penalise ½ mk for no working shown but correct answer is shown

(iii) Wrong answer and no working shown….0mk

(iv) Wrong working with correct answer shown….0mk

NB

(i) Accept rounding off or truncation of answer to 2d.p, otherwise penalize ½ mk for rounding off or truncating to 1d.p or whole number unless it works out exactly to a whole number

(ii) Accept answer if it works out to exactly to 1d.p or whole number

(e) Final accuracy (F.A)…….(1mk)

(Tied to correct averaged titre)

Compare the candidates average titre with the S.V

(i) If within ±0.1 of S.V ……..1mk

(ii) If not within ± 0.1 of S.V but within ± 0.2 of S.V…….. ½ mk

(iv) If not within ±0.2 of S.V…….(0mk)

N/B

(i) If there are 2 possible averaged titre values, use the one that is closer to the S.V and credit accordingly.

(ii) If wrong titre values are averaged by the candidate, pick correct values if any, average and award accordingly

(b)(i) Concentration of diabasic acid, solution B in moles per litre

$$\frac{mas\sin gperlitre}{R.M.M}$$

$$\frac{6.3}{126}\sqrt{1}$$

=0.05M √ ½ /0.05 moles /litre

Conditions and penalities

(i) Penalize fully for strange values other than 6.3 and 126

(ii) Penalize fully for wrong substitution

(iii) Penalize ½ mk for wrong answer if substitution is correct

(iv) Penalize ½ mk for wrong units if shown, otherwise ignore and credit accordingly if units are omitted

(v) Penalize fully if answer is correct and no method is shown

(ii) The concentration of sodium hydroxide, solution C in moles per litre

$2NaOH_{(aq)} + H_2C_2O_{4(aq)} \longrightarrow Na_2C_2O_{4(aq)} + 2H_2O_{(l)}$

Moles of NaOH: $H_2C_2O_{4\,(aq)}$ is 2:1 respectively

No of moles of $H_2C_2O_4$ used

$$\frac{\text{Average titre volume x answer in b(i)}}{1000}$$

Hence no of moles of NaOH used = Answer obtained above x 2

25cm^3 of NaOH =answer above

$100cm^3$ =?

100 x answer obtained
25

OR

No of moles of $H_2C_2O_4$ (aq) used =
Average titre x answer inb(i) = Ans (a) √ ½
1000
No of moles of NaOH used =2xAnswer(a)
$25cm^3$ of NaOH =2x Ans (a)
$1000cm^3$ of NaOH=?
1000x 2x answer (a)=Molarity √ ½
25

Conditions /penalities

(i) The chemical equation must be correct for ½ mk

(ii) Penalise fully for strange values

(iii) Accept method used if correct even if the equation is wrong

(iv) Penalise fully for wrong answer if arithmetic error is beyond ± 2 units to the 5^{th} d.p

(v)Penalise ½ mk for wrong units at every step in the calculation to a maximum of (1 ½ mks)

If not shown, ignore and credit fully

(vi) Accept units M, moles /litre/Mole 1^{-1}/Moles dm^{-3}/moles/dm^3

(vii) Accept any other correct method used by the candidate

Procedure II

Table II

	I	II	III
Final burette reading (cm^3)	26.0	26.0	26.0
Initial burette reading (cm^3)	0.0	0.0	0.0
Titre (cm^3)	26.0	26.0	26.0

Conditions and penalities are as in Table I

(a) $\frac{26.0 + 26.0 + 26.0}{3} = 26.0cm^3$

(b) (i) Concentration of dilute HCl, solution D in moles/litre

$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

Mole ratio of NaOH:HCl=1:1

No. of moles of HCl, solution D used in the experiment

=$\frac{25x \text{ Ans in b(ii) in procdure I}}{1000}$=ans b

26.0cm^3 of HCl = ans b moles

1000cm^3 = ?

=$\frac{1000x \text{ ans b}}{26}$. or $\frac{100x \text{ Ans (b) moles}}{\text{average titre in table II}}$

Conditions and penalities are as above (in (ii) prodecure)

(ii) Concetration of A in moles /liter

Solution D is a derivative of solution A

1000$cm^3$of D ⟶ Ans c

100cm^3 of D ⟶ ?

$\frac{100cm^3 \text{ of Dx Ans C}}{1000cm^3}$√ ½

100cm^3 of solution D has an equal no. of moles of solution A

Hence 10cm^3 =Ans C

1000cm^3 =?√ ½

$\frac{1000cm^3 \text{ x Ans C}}{10}$

=ans √ ½

Procedure III

Table III

Time	0	30	60	90	120	150	180	210	240	270	300
Temp(oC)	22.0	24.0	26.0	27.0	29.0	31.0	32.0	32.0	31.0	30.0	29.0

Distribution of marks

(i) Complete table…….1mk

Conditions

(i) Incomplete table with at least 7 readings ……1mk

(ii) Incomplete table with atleast 7 readings… ½ mk

(iii) Incomplete table with less than 7 readings …..0mk

(iv) Penalize ½ mk if readings given in the table are constant.

(v0 Where there are 2 or more rows of readings, penalize ½ mk and then mark the readings used to plot the graph. However, if no graph is plotted, mark the 1st row in the table. If there are two or more graphs plotted, mark the graph based on the FIRST row,

(vi) For temperature readings showing continuous increase without a constant,, penalize ½ mk for any readings showing above 45.0oC to a maximum of ½ mk

(vii) Penalise ½ mk and treat reading before candidates constant drop in temperature reading which are less than 15.oC as unrealistic to a maximum of ½ mk

(viii) For initial temperature, treat temperature below 10°C and those above 40°C as unrealistic and penalize ½ mk once

(ix) If the candidates reading start with a constant, penalize ½ mk and award accordingly.

B. Use of decimals…….(½ mk)

Conditions and penalties

Accept ONLY if al readings are recorded CONSISTENTLY as whole numbers or ONE d.p of .0 or .5 otherwise penalize fully

C. Accuracy (AC) ….. ½ mk

Compare candidates FIRST READING with the SCHOOL VALUE

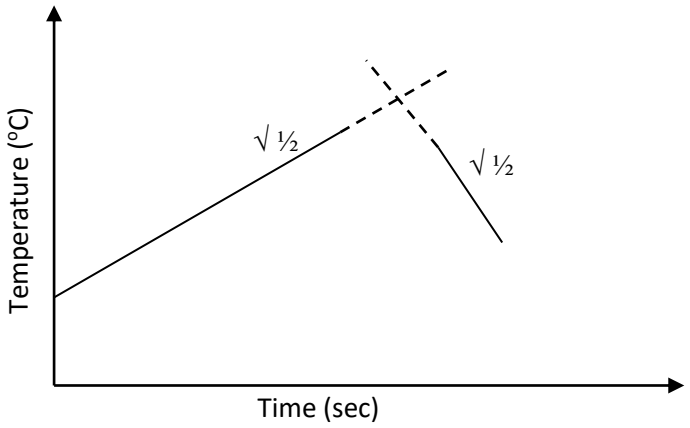
If within ± 2°C of the S.V award ½ mk otherwise penalize fully

D. Trend……(1mk)

Conditions/penalties

(i) Award 1mk for continuous increase in temperature followed by a constant then a drop or a drop (i.e continuous rise in temperature followed by a drop)

(ii) Award only ½ mk when there is a continuous increase in temperature, then a constant without a drop
(iii) Award only ½ mk where there is an increase in temperature, then a constant without a drop
(iv) Award 0mk where there are more than one drop in temperature
(v) Award 0mk where all readings are constant or where there is a temperature decrease
Graph …….3mks
Distribution of marks:
(i) Labelling axes (L.A)…. ½ mk
Conditions and penalties
(i) Penalize fully for inverted axes
(ii) Penalize fully for wrong units otherwise ignore if no units given and award fully
(iii) If only one axis is labeled /anuis given, conditions (ii) above is applied
2. Scale ……(½ mk)
(i) Area occupied by the ACTUAL PLOTS MUST be at least ¾ of the graph paper provided
(ii) Scale intervals MUST be constant/consistent
(iii) The scale chosen must be able to accomidate all the plots points
NB: Penalize fully if any of these three conditions is not met
3.Plotting…..(1mk)
(i) Award 1mk if at least 10 points are correctly plotted
(ii) Award ½ mk if only 7-9 points are correctly plotted, otherwise if less than 7 points are plotted correctly award. 0mk
(iii) If scale intervals are inconsistent then accept plots if any within the FIRST intervals only
(iv) Accept plots even if the axes are inverted and award accordingly



The two lines must be joined by a ruler, otherwise penalize fully.

There must be an evidence of axtrapolation

Conditions and penalties

Award 1mk for an extrapolated ascending straight line followed by an extrapolated descending straight line, otherwise penalize fully

(ii) Correctly read value from extrapolated graph√1nk

(iii) Heat of reaction in this experiment

ΔH=MCΔT

ΔT=Highest values from extrapolated graph-initial temperature

$\Delta H = \frac{40x4.2x\Delta T}{1000} = kJ$ 1mk

Conditions and penalties

(i) ΔT used must be the obtained from the graph whose ascending and descending lines are extrapolated;otherwise award 0mk

(ii) Penalize ½ mk if the units are wrong, if no units, ignore and award accordingly

(iii) Accept error within ±2 units in the fourth digit if answer is in Joules or 3rd D.P if in KJ, otherwise penalize fully
(iv) Ignore formula for ΔH; if given it must be correct otherwise penalize fully
(v) Penalize fully for wrong transfer
(vi) Penalize ½ mk if negative sign is absent.
(iv) No of moles of metal M used
1 mole =-1600kJ
?= Ans in (iii) above in kJ
= answer in (iii) above in kJ x 1 mole
-1600kJ
=Ans
Conditions and penalties
(i) The answer in (iii) above must be transferred intact, otherwise penalize fully
(ii)Accept any error within ± units in the 4 D.P otherwise penalize fully
(iii) Accept Ans. Given to atleast 4 D.P if in kJ, otherwise penalize fully
(iv) Ignore units if omitted, otherwise penalize ½ mk for wrong units
(v) Penalize fully for strange figures
(vi) Penalize fully if the Ans is correct and no method is shown
(v) Mass of metal M
1 mole of M……24g
Asnw in (iv) above…?
= Ans in (iv) above x 24g
1 mo

=Ans √ ½

Conditions and penalties

(i) The value in (iv) above must be transferred intact otherwise penalize fully

(ii) Penalize fully for strange values

(iii) Penalsie ½ mk for an arithmetical error + 2 at the 5th d.p

2. You are provided with solid E. Carry out the following tools and write your observations and inferences in the spaces provided

(a) Place all of solid E into a boiling tube. Add 12cm3 of distilled water and shake thoroughly. Filter the mixture into another boiling tube. Retain the filtrate for use in 2(b) below. Dry the residue using piece of filter papers

(i) Transfer half of the dry residue into a dry test tube. Heat the residue strongly and test any gas produced using a burning wooden splint

Observations	Inferences
-colourless√ ½ , oduorless√ 1.2 gas produced that extinguishes a burning splint; ½ -white solid residue turns yellow on heating white on cooling; ½	-CO_3^{2-} √ ½ (tied to gas extinguishes a burning splint) Zn^{2+}/ZnO ½ (tied to white solid turning yellow on heating, white on cooling; 1mk

1mk	

(ii) Place the other half of the residue in a dry test-tube. Add 3cm^3 of 2M hydrochloric acid. Retain the mixture for test (iii) and (iv) below

Observations	Inferences
Effervesce /bubbles/fizzing ; ½ (½ mk)	CO_3^{2-} √ ½ (Penalize fully for any contradictory ion) Potassium iodide solution dropwise

(iii) To 2cm3 residue add 2cm3 of Potassium Iodide solution dropwise:

Observations	Inferences
No yellow ppt (½ mk)	Pb^{2+} absent (½ mk

(iv) To 2cm3 of the solution obtained in (ii) above, add 4cm3 of aqueous ammonia drop wise

Observations	Inferences
White √ ½ ppt, soluble √ ½ in excess (½ mk)	Zn^{2+} present√1 Penalize fully for any contradictory ion (½ mk)

(b) Divide the filtrate obtained into 5 portins

(i) To the 1st portion of the filtrate obtained in (a) above, add 3cm3 of aqueous ammonia (excess)

Observations	Inference
White ppt insoluble (½ mk)	Al^{3+}, Pb^{2+} present

(ii) To 2nd portion of the filtrate add 2 drops of sodium sulphate solution provided

Observations	Inferences
No white ppt (½ mk)	Al^{3+} present or Pb^{2+} absent

(iii) To the 3rd portion of the filtrate add 2 drops of Barium nitrate solution provided

Observations	Inferences
White ppt (½ mk)	SO_4^{2-}, SO_3^{2-}, CO_3^{2-} present(½ mk)

(iv) To the 4th portion of the filtrate add 2cm3 of 2M hydrochloric acid

Observations	Inferences
No. effervescence No white ppt	Co_3^{2-} or SO_3^{2-} absent Absence of Pb^{2+}/Al^{3+} present

(v) To the 5th portion of the filtrate add two drops of Lead (II) nitrate solution and heat to boil

Observations	Inferences
White ppt soluble on heating (½ mk)	Cl- present

3. You are provided with solid F. Carry out the tests below and record your observations and inferences in the spaces provide

(a)(i) Using a metallic spatula, heat half of solid F in a non-luminous burnsen burner flame for some time then remove when it ignites

Observations	Inferences
Melts burns with a sooty/smoky/luminous yellow flame√1 (accept melts on its on for ½ mk)	C= C or - C≡ C- present √1 Organic compound with high C:H ratio long chain organic compound (½ mk)

(ii) Put a half spatula endful of solid F into a boiling tube. Add about 10cm3 of distilled water and shake vigorously

Observations	Inferences
Dissolves into a colourless solution ½ mk	Soluble compound /salt/polar substance ½ mk

(b) Divide the resulting solution into two portions

(i) To the first portion, dip a piece of universal indicator paper and dertermine its PH

Observations	inferences
pH_5 √ ½	Weakly H^+/-COOH √ ½ (½ mk

(ii) To the second portion, add two drops of acidified potassium manganate (VII) solution and shake vigorously

Observations	Inferences
$H^+/KMnO_4$ decoclourises √1 (½ mk)	C= C or –C≡ C- present √ ½ Or R-OH present √ ½

© Put half spatula of solid F into a boiling tube and ad 5 drops of ethanol followed by 2 drops of concentrated Sulphuric (Vi) acid warm the mixture

Observations	Inference
Pleasant /fruity smell (½ mk)	- C(=O) - O or R - C(=O) - O- R (½ mk)

(II) You are provided with liquid G. Use it to carry out the following tests an record your observations and inferences below

(i) To the first portion add 2 drops of acidified Potassium Manganate (VII) solution

Observations	Inferences
H^+,$KMnO_4$ decolourises	

(½ mk)	C = C- or R-OH present (½ mk)

(ii) To the second portion, dip the blue and red litmus papers provided

Observations	Inferences
Blue litmus remains blue Red litmus remain red (½ mk)	Neutral compound (½ mk)

(iii) To the third portion, add 2 drops of acidified Potassium dichromate (VI) solution

Observations	Inferences
Orange $H^+/K_2Cr_2O_7$ solution turns green(½ mk)	R-OH present (½ mk)