Wash the apparatus and repeat the procedure for the stated temperature of M at 60°C, 70°C and 90°C to complete table II.
Computer $^1/_t$ to complete the table.

Table II

Temp. of solution M °C	50	60	70	90
Time taken for decolourisation, t (sec)				
$^1/_t$ sec^{-1}				

a) i) Draw a graph of $^1/_t$ sec^{-1} (vertical axis) against temperature of solution M. (3 marks)
ii) From your graph determine time taken for decolourisation to occur if temperature of solution M is 80°C. (2 marks)

2. You are provided with solid K. Carry out the following tests on it and record your observations and inferences.

a) Put a sample of solid K into a boiling tube. Add 15cm^3 of distilled water. Shake well.

b) Divide mixture in (a) onto four portions of 2cm^3 each in separate test tubes for tests that follow.
i) To first portion add ammonia solution dropwise till in excess. (3marks)
ii) To second portion add 2cm^3 of dilute sulphuric (VI) acid. (3marks)
iii) To third portion add sodium hydroxide dropwise till in excess. (3marks)
iv) To fourth portion add 3 drops of lead nitrate solution and boil the mixture. (3marks)

3. Divide solution M prepared in question 1 into four portions of 2cm^3 each into separate test tubes for tests i - iv.
i) To first portion add sodium hydrogen carbonate provided. (3marks)
ii) To the second portion add 3 drops of acidified potassium chromate VI. (3marks)
iii) To the third portion add 3 drops of bromine water. (3marks)
iv) To fourth portion add 1cm^3 of ethanol followed by 2 drops of conc. sulphuric VI acid. Warm the mixture and leave to cool. (3marks)

KISII CENTRAL FORM 4 JOINT EVALUATION
233/1
CHEMISTRY
Marking scheme

1. a) 1 ✓1
b) Alkali metals ✓1
c) 2.8.8 ✓1

2. a) Under same conditions of temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density ✓1

b)
$$\frac{R_{SO_2}}{R_{CO_2}} = \frac{\sqrt{M_{CO2}}}{M_{SO2}}$$
$$\frac{40}{R_{CO_2}} = \frac{\sqrt{44}}{\sqrt{64}}$$
$$R_{CO_2} = \frac{40\sqrt{64}}{\sqrt{44}}$$
$$= 48.24 cm^3 s^{-1}$$

3. HCl dissociates in water ✓1 to form acidic solution that reacts with MnO_2. In methylbenzene, HCl remains in molecular ✓1 form hence does not react with MnO_2 (owtte)

4. a) Separating funnel ✓1
b) Propane ✓1 does not react with NaOH solution ✓1

5. a) The solution turns brown ✓1
$Cl_{2(g)} + 2I^-_{(aq)} \rightarrow 2Cl^-_{(aq)} + I_{2(aq)}$ ✓1
b) Covalent ✓½. There is sharing of electrons ✓½

6. Heat evolved = 500 x 4.2 x 11 ✓½
= 23100J ✓½
or 23.1kJ

0.6g of J → 23.1KJ ✓1
= 380KJ
$= \frac{380 \times 0.6}{23.1}$ ✓½
= 9.87 ✓½

7. a) Prevents molten iron from reoxidation ✓1
b) Preheating air fed at the bottom of the furnace
c) To produce CaO for removal of silica impurities ✓1

8. a) i) 208 + 4m = 216 ✓½
m = 2 ✓½

ii) $82 + 4 - n = 84$ ✓½

$n = 2$ ✓½

b) Nuclear fusion is the combining of light nuclei to form a heavy stable nucleus. Nuclear fission is the splitting of a heavy nuclide to form smaller stable nuclides ✓1 *tied*

9. a) Molarity $= \frac{36}{100} \times \frac{1.18 \times 1000}{36.5}$ ✓1

$= 11.64M$ ✓1

b) $V_c = \frac{M_d V_d}{M_c}$

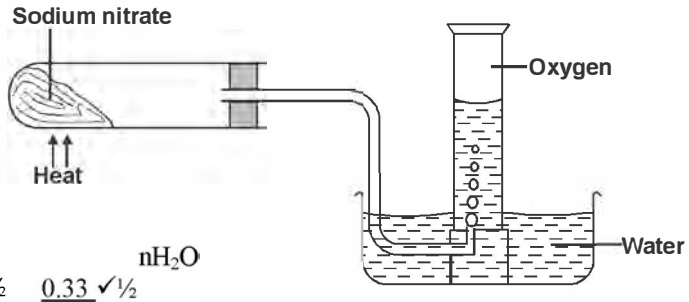
$= \frac{1 \times 1000}{11.64}$ ✓½

$= 85.91 cm^3$ ✓½

10. React Cu metal with dilute HNO_3 to obtain $Cu(NO_3)_2$ solution. ✓1 Add Na_2CO_3 / K_2CO_3 / $(NH_4)_2CO_3$ solution to the $Cu(NO_3)_2$ solution. ✓1. Filter ✓½ to obtain $CuCO_3$ as a residue ✓½.

11. The brown colour intensifies;✓1 H_2SO_4 removes OH^- ✓½ from the mixture thereby favouring ✓½ backward reaction

12.



13.

$CaSO_4$	nH_2O
$\frac{2.485}{136}$ ✓½	$\frac{0.33}{18}$ ✓½
$\frac{0.0183}{0.0183}$	$\frac{0.0183}{0.0183}$ ✓½
1	1

$n = 1$ ✓½

14. a) $2Cr_{(s)} + 3Fe^{2+}_{(aq)} \rightarrow 2Cr^{3+}_{(aq)} + 3Fe_{(s)}$ ✓1

b) $+0.30 = -0.44 - E^{\ominus}ox.$ ✓1

$E^{\ominus}ox = -0.74V$ ✓1

15. a) $CO_{(g)} + PbO_{(s)} \rightarrow Pb_{(s)} + CO_{2(g)}$ ✓1

b) Grey solid ✓1

c) Ammonia ✓1

16. a) C ✓1

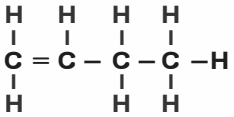
b) A ✓½ and D✓½, ZnO is amphoteric ✓1

17. a) Nitric (V) acid / HNO_3 ✓1

b) $Cu_{(s)} + 4HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + 2NO_{2(g)} + 2H_2O_{(l)}$ ✓1

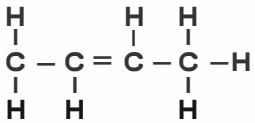
c) Downward delivery ✓1 / upward displacement of air

18. a) i)



But-1-ene ✓½

ii)



But-2-ene ✓½

b) Substitution reaction ✓1

19. a) A - solvent front ✓½

B - base line ✓½

b) Propanone / ethanol ✓1

c) F ✓1

20. Effective nuclear charge ✓1 increases across the period hence electron in the outermost energy level is strongly attracted ✓1 to the nucleus more energy is required to remove the electron (owtte)

21. a) Heat ✓1

b) Heating melts PbI_2 ✓1 thereby setting Pb^{2+} and I ions free to move ✓1

22. a) Hydrogen sulphide ✓1

b) -thistle funnel is not dipped ✓1 into the reactants. Gas escapes through it
delivery tube is dipped into the reactants. ✓1 No gas can be delivered

23. $Na_2SO_{3(s)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)}$ ✓½

Moles of $SO_2 = \frac{960}{24000}$ ✓½

$= 0.04$ ✓½

Moles of $Na_2SO_3 = 0.04$ ✓½

Mass of $Na_2SO_3 = 0.04 \times 126$ ✓½

$= 5.04g$ ✓½

24. a) Cl^- ✓1 (reject name)

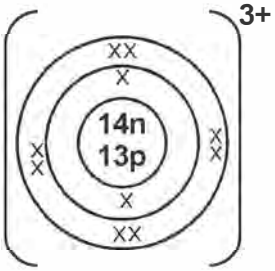
b) $Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow PbCl_{2(s)}$

c) Permanent hardness ✓1

25. a) Curve I ✓1 - concentration of reactant decreases ✓1 with time as it is consumed

b) Chemical / dynamic equilibrium ✓1

26.



✓1 electron distribution

✓1 composition of nucleus

27. Use of polymer

i) Chloroethene ✓½-making car dash boards etc

ii) Polypropene✓½ - making crates, bottles, chairs ✓½ etc.

28. a) The maximum mass of solute required to saturate 100g of solvent at a particular temperature ✓1

b) Solubility $= \frac{60}{80} \times 100$ ✓1

$= 75g / 100g$ of H_2O ✓1

29. Dissolve ✓½ each oxide in water and test the solution with litmus indicator.✓½ The indicator turns blue ✓½ in oxide of M and red in oxide of N ✓½

KISII CENTRAL FORM 4 JOINT EVALUATION

233/2

CHEMISTRY

Marking scheme

1.

a) i) H ✓1 smallest ✓½ halogen with the highest ✓½ electron affinity OWTTE

ii) Melting point of D is higher. ✓1. D has stronger ✓1 metallic bonds

iii) K has a greater ✓1 nuclear charge (owtte)

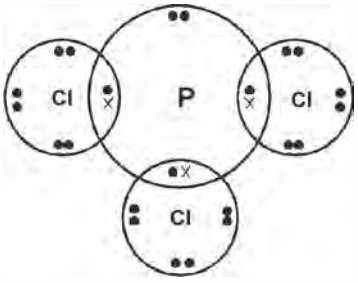
iv) P_3G_6 ✓1

v) $C_{(s)} + H_{2(g)} \rightarrow CH_{2(s)}$ ✓1

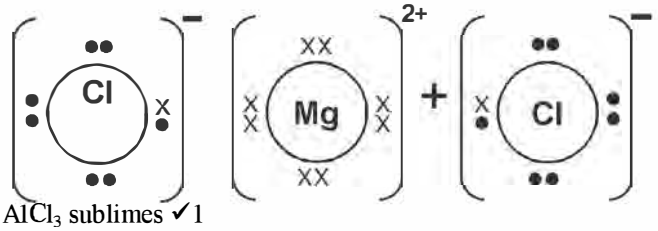
or

$Be_{(s)} + F_{2(g)} \rightarrow BeF_{(g)}$

b) i)



ii)



ii) $AlCl_3$ sublimes ✓1

iii) MgO forms giant ionic ✓½ ionic structure with strong ionic bonds ✓½. P_2O_5 forms molecular ✓½ structure with weak Van der waals forces ✓½.

2.

a) i) Fractional distillation ✓1

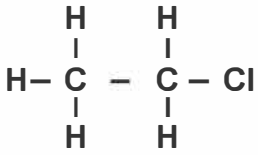
ii) difference in boiling points ✓1
-difference in densities ✓1

b) i) C_3H_8 ✓1

ii) Pass each through acidified $KMnO_4$.✓1 C_3H_6 decolourises ✓½ $KMnO_4$ while C_3H_8 does not ✓½
or
Burn a sample of each. C_3H_6 burns with yellow sooty flame while C_3H_8 burns with non-sooty flame

c) i) Chloroethene ✓1

ii)



✓1

d) i) Ethanol / C_2H_5OH ✓1

ii) Dehydration ✓1

iii) Slightly soluble in water ✓1

iv) - carbon (IV) oxide ✓½
- sulphur (IV) oxide ✓½

3.

a)

- electrolysis of brine ✓½
- natural gas
- cracking alkanes ✓½ *any correct 2*

b) i) Platinum - rhodium ✓1

ii) $4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$ ✓1

iii) Pale blue ✓½ precipitate that dissolves into a deep blue solution ✓½

iv) $[Cu(NH_3)_4]^{2+}$ ✓1

v) Oxidising ✓1

vi) As a fertilizer ✓1

c) $NH_{3(g)} + HNO_{3(aq)} \rightarrow NH_4NO_{3(aq)}$ ✓½

Moles of NH_3 = $\frac{1.8}{24}$ ✓½
= 0.075 ✓½

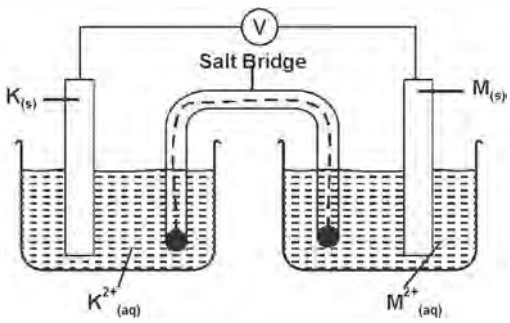
Moles of NH_4NO_3 = 0.075 ✓½
Mass of NH_4NO_3 = 0.075 x 80 ✓½
= 6g ✓½

4.

a) i) L; ✓1 E^{θ} value is 0.00V ✓1 / reference electrode

ii) +2.87 volts ✓1

iii)



iv) E^{θ}cell = +0.34 - -2.38 ✓½

= + 2.72V ✓½

b) i) $Cu_{(s)} \rightarrow Cu^{2+}_{(aq)} + 2e^{-}$ ✓1

ii) Q = 0.5 x 2 x 3600 ✓½

= 3600C ✓½

2 x 96500C → 64g of Cu ✓1

3600C → ?

$= \frac{64 \times 3600}{2 \times 96500}$

= 1.1938g ✓1

c) To prevent corrosion of the metallic items ✓1

5.

a) i) Hydrogen ✓1

ii) Reducing ✓1

iii) I. $CuSO_4.5H_2O_{(s)} \rightarrow CuSO_{4(s)} + 5H_2O_{(g)}$ ✓1

II. $Mg_{(s)} + H_2O_{(g)} \rightarrow MgO_{(s)} + H_{2(g)}$ ✓1

b) i) Blue ✓½ crystals changed to white powder ✓½ due to loss of water crystallisation ✓1

ii) Black ✓½ CuO changed to brown ✓½ due to reduction ✓1 by hydrogen gas (gas P)

c) i) To produce steam ✓1

ii) To lower ✓1 the freezing point of water

iii) Investigate if its boiling point is fixed sharp at 100°C ✓1

d) Gas P (hydrogen) is flammable ✓1

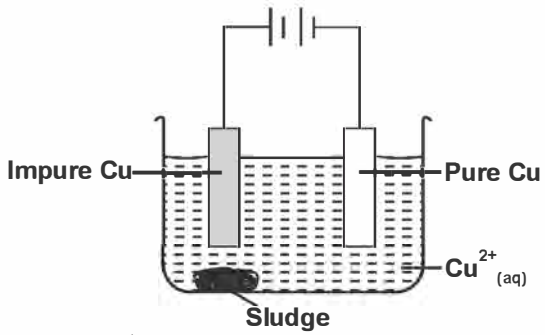
6. a) Copper pyrites ✓1

b) Froth floatation ✓1

c) Silica (SiO_2) ✓1. To remove FeO ✓1

d) $2CuFeS_{2(s)} + 4O_{2(g)} \rightarrow Cu_2S_{(s)} + 2FeO_{(s)} + 3SO_{2(g)}$

e)



labelling ✓1

correct diagram ✓1

f) - escaping SO_2 ✓1 leads of air pollution

- leaves gaping holes ✓1

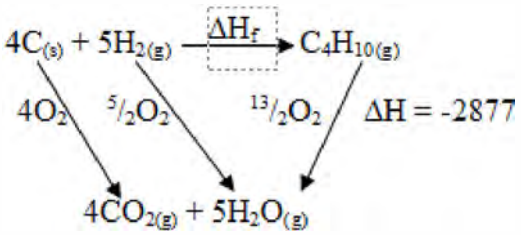
g) i) Sn ✓1

ii) Making coins and ornaments ✓1

7.

a) Energy change in converting reactants into products is the same regardless of the route by which the chemical change occurs ✓1

b)



ΔH_f = (4 x -393 + 5x - 286) - (-2877) ✓1
= -125kJmol^{-1} ✓1

c) Hydration energy of fluoride (F^{-1}) is greater ✓1. F^{-1} is smaller ✓½ hence attracts more water molecules more closely leading to evolution of more energy ✓½

d) ΔH_1 ✓½ and ΔH_3 ✓½. Heat content of the products is lower than that of reactants ✓1

e) $\Delta H_1 = \Delta H_2 + \Delta H_3$ ✓1

f) i) Amount of heat energy given out when a unit mass / volume of a fuel is completely burnt in oxygen ✓1

ii)
- readily available ✓1
- cheap
- can be easily transported
- burn slowly
- do not produce poisonous products when burnt *any one correct*

KISII CENTRAL FORM 4 JOINT EVALUATION
233/3
CHEMISTRY
Marking scheme

Procedure 1 - Table 1 (5 marks)

a) Complete table **1mk**
Conditions
Complete table with 3 titrations done - 1mk
Incomplete table with 2 titrations done - ½mk
Incomplete table with 1 titration done - 0mk

Penalties
- wrong subtraction
- inverted table
- burette readings beyond 50cm^3 unless explained
- unrealistic titre values i.e. less 1cm^3 or in hundreds

Penalise ½mk each to maximum of ½mk

b) Use of decimals1mk (tied to first and second rows only)
Accept one or two decimals used consistently otherwise penalise fully (award zero marks)
If two decimals are used then the second digit must be 0 or 5 otherwise penalise fully
Accept inconsistency in use of zero's on initial burette readings e.g. 0, 0.0, 0.00

c) Accuracy **1mk**
compare the candidates titre values with the school value and tick the chosen value if it earns a mark and award as follows :
i) If at least one is within ±0.1 of S.V award 1mk
ii) If none is within ±0.10 of S.V but at least one is within ±0.20 of S.V award ½mk
iii) If no value is within +0.2 of S.V award 0mk

Note:
If there was wrong subtraction or no subtraction done in table, compare correctly worked value with S.V and award accordingly

d) Principles of averaging **1mk**
Conditions
i) 3 titrations done and are consistent and averaged 1mk
ii) 3 titrations done but only 2 are possible and averaged 1mk
iii) If only 2 titrations done and are consistent and averaged 1mk
iv) If 3 titrations done, inconsistent and averaged 0mk
v) If 3 titrations done and are consistent but 2 averaged 0mk
vi) Only 2 titrations done and inconsistent and averaged 0mk
vii) Only 1 titration or none 0mk

Penalties
penalties ½mk for wrong arithmetic if error is outside 2 units in the second decimal place
penalise ½mk if no working shown but correct answer given
if no working shown but answer given is wrong penalise fully 0mk
accept rounding off / truncation of answer to 2d.p e.g. 21.666 as 21.66 or 21.67 otherwise penalise ½mk for round off to 1d.p.
accept answer if it works out exactly to 1d.p or a whole number

e) Final accuracy (tied to correct average titre ..... 1mk)

Compare the candidates correct average titre with S.V used in (c) and award as follows :

i) If within ±0.10 of S.V 1mk
ii) If not within ±0.10 but one is within ±0.20 of S.V award ½mk
iii) If not within ±0.20 of S.V award 0mk

Note:
If there are two possible average titres from the candidate's result, use the one closer to S.V and credit accordingly
if wrong principles are used by the candidate pick the correct values (if any) average and work accordingly
Calculations :

b) $2NaOH + H_2A \rightarrow Na_2A + 2H_2O$
2 mole 1 mol
Moles of NaOH used = $\frac{\text{ans a x } 0.5}{1000}$ ✓½
= ans ✓½
Moles of dibasic acid in $25cm^3$ of solutin M
= ½ x moles of NaOH above
= ✓ ans ✓½

c) $25cm^3$ of M = ans b
$250cm^3$ " = ?
= $\frac{250}{25}$ x ans b
= ✓ ans ✓½

d) Molar mass of M = $\frac{6.3}{\text{ans c}}$ ✓1
= ✓ ans ✓½
(no units)

e) 2 + 88 + x(16 + 2) = ans d
90 + 18x = ans (d) ✓1
18x = ans d - 90
x = $\frac{\text{ans d - 90}}{18}$ ✓½ = ans(whole no)

Conditions
* Penalise fully for all wrong workings in (b) to (e)
* Penalise fully for any strange figures used in calculations
* 6.3 must be used intact in (d) otherwise penalise fully

Sample results

F.B.R.	18.9	18.8	28.7
I.B.R	0.0	0.0	0.0
Vol. of NaOH	18.9	18.8	18.7

Procedure II - Table II

a) i) Complete table with 8 readings - 3mks
ii) Incomplete table with 6 or 7 readings - 2mks
iii) Incomplete table with 4 or 5 - 1mk
iv) Incomplete table with 3 " - ½mk
v) Incomplete table with 2 or less - 0mk

Conditions
* Penalise ½mk for each incorrect value of $^1/_t$ or value rounded to less than 3d.p unless it works exactly to a whole no or 1d.p or 2d.p to a maximum of 1mk

b) Use of decimals **½mk**
Time taken should be recorded either as whole nos or to 2d.p used consistently otherwise penalise fully

c) Accuracy **1mk**
Compare the first time record at 50°C of school value to candidates reading.
If within + 2°C award 1mk otherwise penalise fully (award zero)

d) Trend **½mk**
Time progression should be consistently a continuous drop from temp. 50°C to 90°C otherwise penalise fully for trend

a) Graph **3mks as shown**

i) Labelling of axes **½mk**
Award ½mk if both axes are correctly labelled
Penalties
- Penalise fully (award zero) for inverted axes
- Penalise fully if wrong units are attached on axes, otherwise ignore if units are omitted
- Penalise fully if only one axis is labelled

ii) Scale **½mk**
Conditions
- Area covered by the plots should be at least half of the grid provided in each axis
- Scale intervals must be consistent on each axis
- Scale chosen must accommodate all plots (points) whether plotted or not (check from the table the range of his/her readings)

Note:
Award ½mk for correct scale even if the axes are inverted
Penalise fully if any of the above conditions are not met

iii) Plotting 1mk
Conditions
- If 3 or 4 points are correctly plotted award 1mk
- If 2 points are correctly plotted - ½mk
- If only 1 or none is plotted - 0mk

Note:
If scale intervals are inconsistent tick the plots if any within the first correct interval and credit accordingly
- Accept correct plots even if axes are inverted and award accordingly
- Mark all plots with a tick (✓) or cross (x)

d) Line / shape 1mk
- Accept a correct line passing through at least 2 correctly plotted points and the origin as the third point for 1mk
- Accept a line of best fit passing through one correctly plotted point and the origin for 1mk

a) (ii) Calculation for time at 80°C
- showing and correct reading of $^1/_t$ at 80°C 1mk
- time = reciprocal of $^1/_t$ 1mk
- Penalise fully if working is from wrong showing of $^1/_t$ and its value
- Accept answer as whole number or to 2d.p only for time otherwise penalise ½mk for answer

2.

Observation	Inference
a) Solid K dissolves ✓½ to form colourless solution ✓½	Polar / soluble / ionic compound ✓½
b) i) White ppt ✓½ insoluble in excess ✓½	Mg^{2+}, Ba^{2+}, Pb^{2+}, Al^{3+} 4 ions = 1mk 2 or 3 = 1mk 1 = 0mk
ii) No effervescence ✓½	Absence of HCO^-_3, CO^{2-}_3, SO^{2-}_3 ✓1 for ions ½mk for 2 ions
No white ppt ✓½	Mg^{2+}, Al^{3+}, 1mk - 2 ions ½mk - 1 ion
iii) White ppt soluble in excess ✓½	Al^{3+} ✓1
iv) White ppt ✓½ that dissolves on boiling ✓½	Cl^- ✓1

Rectangle

3.

i) Effervescence ✓1 / bubbles / fizzing		H^+; H_3O^+; R-COOH ✓1
ii) Orange $K_2Cr_2O_7$ remains orange / does not turn to green ✓1		R-OH absent ✓1
iii) Orange / yellow bromine water does not turn to colourless ✓1		$-C=C-$ or $-C\equiv C-$ ✓1 absent
iv) Colourless solution that has a pleasant ✓½ smell forms ✓½		R-COOH ✓1