MACHAKOS COUNTY KCSE TRIAL AND PRACTICE EXAM 2015

Kenya Certificate of Secondary Education (K.C.S.E)

CHEMISTRY

Paper 1

Time: 2 Hours

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1. a) Q 2, 3, 6 ✓1

R 2, 8, 3✓1

b) R_2Q_3 ✓1

2. It is required to break the strong N≡N ✓ 1triple covalent bond.

3.

- Prevents knocking of engines
- Prevents premature ignition
- Increase the octane rating number (any ✓1)

4. $Zn_{(s)} + Zn^{2+} + 2e-$ ✓ 1

- The cell does not produce any current/stops working (any ✓ 1)
- Because the ions are not mobile, the solid is a non-electrolyte ✓1

5. a) At a constant temperature the volume is inversely proportional to pressure.✓
   - OR $v\alpha \frac{I}{P} = V = \frac{K}{P}$

   a) $V = \frac{K}{P}$

   $V_1P_1=V_2P_2$

   1500x1=V_2x2✓1

   $V_2 = \frac{1500x1}{2} = 750cm^3$ ✓1

6. a) Y-At room temperature (25^0c) Y is a liquid since its M.P and B.P lie between -7°c and 58.8^0c OR (room temperature is between M.P and B.P.)

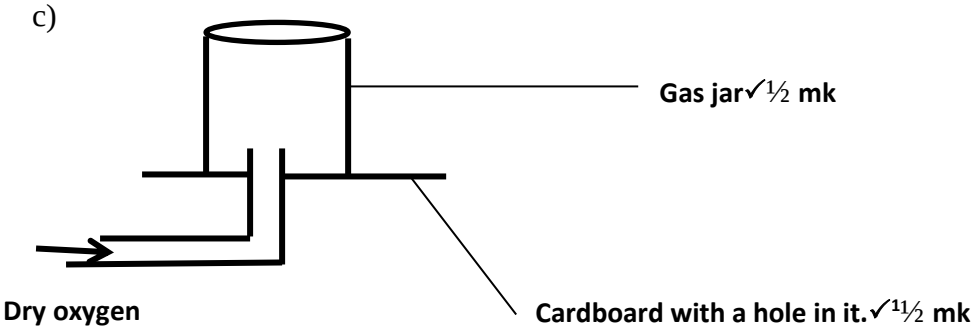
   b) The molecular mass of x is higher✓1 than that of Z; the Vander Waals forces are stronger ✓in X molecules than in Z molecules hence X has a higher boiling point than Z.

7. a) I water ✓ ½ mk

   II concentrated sulphuric acid✓ ½ mk

   b) $2Na_2O_{2(s)} + 2H_2O(l) \longrightarrow 4NaOH_{(aq)} + O_{2(g)}$ ✓ 1

   c)



8. a) $E = E_{red} - E_{ox}$
$= -0.44 + +1.66$
$= +1.22$v✓ 1
b) G, E, F✓ 1
c) Yes✓$^1/_2$mk- G cannot be displaced the E^{2+} ions because it is less reactive than E.✓ ½ mk
9. a) Brown red vapour of bromine gas produced.
b) Q =It
$= 2.5x30x60$

$No.of\ feradays = (\frac{2.5x30x60}{96500})$ F

$1\ mole\ Pb \rightarrow 2F$

$\rightarrow \left(\frac{2.5x30x60}{96500}\right) F$

$\frac{1}{2} x \frac{2.5x30x60}{96500} x207$ ✓$1 = 4.82g$ ✓1

10. a) KOH✓1
b) Plants need potassium ✓$^1/_2$on large scale; potassium is a macro nutrient therefore the ash contains K_2O✓$^1/_2$
Would turn yellow✓1
11. a) Mass No of C=38✓½
Atomic No =17✓½
b) $^{37}_{18}B + {}^{0}_{-1}e \rightarrow {}^{37}_{17}A$ ✓1
c)
- C_0-60 is used to destroy cancerous tissue in patients without serious damage to other tissues.
- Sterilization of surgical instruments using gamma radiation.
- Radioactive iodine-131 is used in the treatment of goiter
- To monitor growth in bones and healing of fractures
- Detecting leakages in underground water or oil pipes without digging them out. (any ✓1)

12. a) $Ca(OH)_{2\ (aq)} + CO_{2(g)} \longrightarrow CaCO_{3(s)} + H_2O_{(l)}$✓1
b) White precipitate dissolves✓1 because the insoluble $CaCO_3$ ✓½ is changed into soluble calcium hydrogen carbonate.✓ ½
13. a) $mass\ of\ oxygen = 9.04 - 8.40$
$= 0.64g$
$mass\ of\ iron = 8.40 - 6.72 = 1.68g$
$Fe\ \frac{1.68}{56} = 0.03$ ✓

$O\ \frac{0.64}{16} = 0.04$ ✓

Mole ratio 3:4
Hence molecular formula F_3O_4✓1
b) $Fe_3O_{4(s)} + 4CO_{(g)} \longrightarrow 3Fe_{(s)} + 4\ CO_{2(g)}$
14. a) I $CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2\ (aq)}$
II $Ca(OH)_2 + CO_2 \longrightarrow CaCO3_{\ (s)} + H_2O_{\ (l)}$
b) Excess oxygen✓1 and nitrogen✓1/helium✓1/neon/argon (accept a name of inert gas)

15. a) $Ca(OH)_2$ paste ✓1

b) $Al^{3+}_{(aq)} + 3OH^-_{(aq)} \longrightarrow Al(OH)_{3(s)}$ ✓1

16. $\frac{25x1000x28}{132x1000} = 5.3kg$ ✓1

17. a) Zinc blend/ZnS

a) $2ZnS_{(s)} + 3O_{2(g)} \longrightarrow 2ZnO_{(s)} + 2SO_{2(g)}$

b)

- Manufacture of dry cells
- Galvanizing iron sheets
- Making of allows e.g. brass (any ✓1)

18. R.M.M of H_2O=18

R.M.M of Na_2CO_3=106

$moles\ of\ H2O = \frac{14.5}{18} = 0.805$ ✓½

$moles\ of\ Na2CO3\ \frac{85.5}{106} = 0.806$ ✓½

$Mole\ ratio\ 1:1$ ✓1

$hence\ n = 1$ ✓1

19. a) Add $200cm^3$ of 2M HNO_3 to $200cm^3$ of 2M NaOH

Filtrate with a suitable indicator get end point ✓$^1/_2$-repeat without indicator ✓$^1/_2$

Crystallize the filtrate ✓½

$2NaNO_{3(s)} \longrightarrow 2NaNO_{2(s)} + O_{2(g)}$

20. Propanoic ✓ acid and ethanol.✓

21. $2HNO_{3(l)} + Mg_{(s)} \longrightarrow Mg(NO_3)_{2(aq)} + NO_{2(g)} + H_2O_{(l)}$

$Mg_{(s)} + 2HNO_{3(aq)} \longrightarrow Mg(NO3)_{2(aq)} + H_{2(g)}$

22. a) Add distilled ✓$^1/_2$ water to the soil sample and stir. Add 2 drops of universal indicator ✓$^1/_2$ to the mixture and compare with the PH chart ✓½.

b)

- Extensive use of acidic fertilizers
- Pollution by acid rain. (any ✓1)

23.

Salt	Adding water	Heating
Calcium carbonate	Does not dissolve	Forms a white solid
Calcium hydrogen carbonate	Dissolves to form a colorless solution	Forms a white solid and a colourless liquid form on the upper cooler parts of the apparatus

24.

- Place the mixture on a piece of paper and put a magnet ✓1above the mixture to attract iron filings
- Heat the remaining part of the mixture for Al_2Cl_3 ✓1to sublime and collect sublimate.
- Calcium chloride will remain at the bottom of the tube.✓1

25. A✓1-does not form scum with hard water.✓1

26. a) ΔH_1-lattice energy✓1

ΔH_2-Hydration energy✓1

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

27. a) Oxalic acid ✓$^1/_2$ and concentrated sulphuric acid ✓½

b) $NaOH_{(aq)} + CO_{2(g)} \longrightarrow Na_2CO_{3(aq)} + H_2O_{(l)}$

c) CO: Colourless✓½ and odourless✓$^1/_2$

28. a) Copper II ions✓1

b) Tetra amine copper ions✓1

29. a) Dilute nitric (v) acid✓

b) $AgNO_{3(s)} \longrightarrow Ag_{(s)} + NO_{2(g)} + O_{2(g)}$✓1

c)

- Aiding patients with breathing problems
- Welding metals
- Used during climbing of high mountains and deep sea diving (any ✓1)

30. The PH of 0.1M KOH is higher✓½ than that 0.1M aqueous ammonia. KOH is strongly/completely dissociated✓½ in solution while aqueous ammonia is partially ✓½ dissociated in solution.

31. i. Vulcanisation ✓1

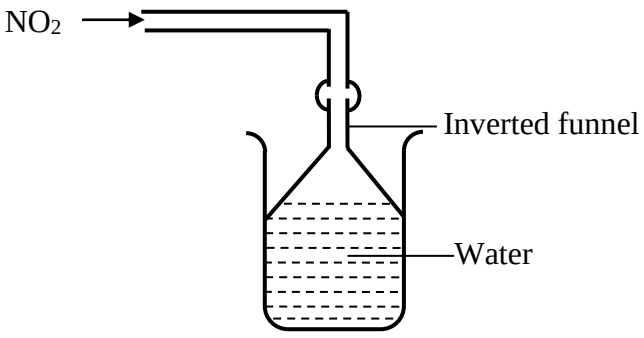
ii. To harden rubber ✓1-the sulphur atoms form link between chains or rubber molecules reducing the number of double bonds in the polymer.✓1

MACHAKOS COUNTY KCSE TRIAL AND PRACTICE EXAM 2015

233/2 CHEMISTRY

PAPER 2 MARKING SCHEME

1. (a) P = 15
   Ne = 20.0
   H = 1
   C = 12.0
   Each ✓ ½ Mark
   (b) (i) The one of atomic number 24 ✓ 1 because it is closer to R.A.M (24.3) that means it contributes to R.A.M more than the other two ✓ 1.
   (ii) Isotopes are atoms of the same element with the same number of protons but different number of neutrons. ✓ 1
   (c) (i) Isotopes are crystalline forms of the same element in the same physical state.
   (ii) Sulphur and carbon Any ✓ 1
   (iii) Red phosphorous ✓ ½ because it has a higher melting point. ✓ ½
   (d) The melting point of aluminium is higher than that of sodium ✓ 1 because its effective nuclear Charge ✓ 1
   OR
   Aluminium contributes more ✓ 1 electrons to the metallic bonding as compared to sodium which contributes less ✓ 1
   (e) Al_4C_3 ✓ 1
2. (a) (i) Dilute Sulphuric acid ✓ 1/Acidified water
   (ii) Red – hot platinum ✓ 1
   (iii) A temperature of 30^0C or 303K
   Forward reaction is exothermic ✓ ½ and is favoured by reduction in temperature inorder to produce the maximum ✓ ½ yield of Nitrogen (IV) oxide
   (iv)



   (v) Fractional distillation ✓ 1 of the dilute acid.
   (vi) It continues ✓ ½ to burn fuming reddish-brown fumes of Nitrogen (IV) oxide ✓ ½
   (vii) Fractional distillation ✓ ½ of liquid air to obtain nitrogen at -196^0C ✓ ½
   (viii) $NH_{3(g)} + HNO_3 \rightarrow NH_4NO_{3(aq)}$ ✓ 1
   (ix) Nitrogen (I) Oxide ✓ ½
   (b) (i) $3Mg_{(s)} + N_{(g)} \rightarrow Mg_3N_{2(s)}$
   (ii) Argon/Neon/Helium/ name of a noble gas ✓ ½ - Is inert ✓ ½ and hence did not react with air.
   (c) (i) Decrease in presence shifts the equilibrium to the left ✓ ½, lowering ✓ ½ the yield of ammonia.
   (ii) - Manufacture of Nitric (V) acid any ✓1
   - Raw material in the Solvay Process for manufacture of soda ash
   - Removal of stains

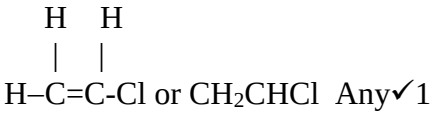
- Manufacture of nitrogenous fertilizers

3. (a) (i) I Name – Limestone ✓ 1
II Use – To produce Calcium Oxide which reacts with Silica to form slag ✓ 1
(ii) – Magnetite, Fe_3O_4 Any ✓ 1
- Siderite, $FeCO_3$
- Iron pyrites
Accept both the name and/ or a correct formula
(iii) Slag is immiscible with molten iron ✓ 1
(iv) I. Blowing/passing oxygen into molten iron which converts carbon to carbon (IV) oxide.
II. To make iron less brittle/to increase tensile strength/to make it more malleable
(v) The reaction between coke and hot air is highly exothermic ✓ 1

(vi) Air reacts with coke to form Carbon (IV) Oxide ✓ 1. The reaction Carbon (IV) oxide reacts with coke to form Carbon (II) Oxide✓ 1, which reduces ✓ 1 Iron (II) Oxide to form iron.
(vii) Cast iron is impure ✓ 1
(viii) Nitrogen (IV) oxide forms acid rain ✓ 1 which corrodes metallic materials ✓ 1/destroys vegetation in the environment/destroys stone buildings.

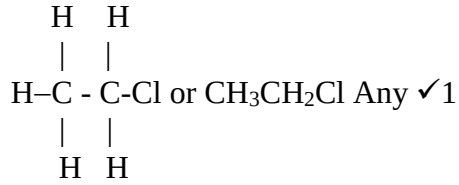
4. (a) Hydrocarbon ✓ 1
(b) (i) 2,2 – dimethylbutane ✓ 1
(ii) Pent-2-yne ✓ 1
(c) When acidified $KMnO_4$ or bromine water is added separately into each of the compounds, compound (ii) decolourises the reagents ✓ 1 while compound (i) does not.
OR
Burn each of the compounds; Compound (ii) burns with a yellow flame (luminous flame) while compound (i) burns with a blue flame (non-luminous flame)

(d) P_1



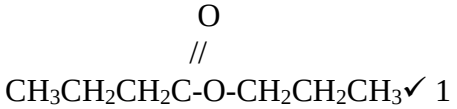
$H–C=C-Cl$ or CH_2CHCl Any✓1

P_2



$H–C-C-Cl$ or CH_3CH_2Cl Any ✓1

(e) (i) Name of process – Thermocracking ✓ ½
Conditions – Heat, temperature ≥ 400K ✓ ½
Catalyst temperature ≥ 700K
(ii) Ethane | CH_3CH_3|C_2H_6 any ✓1
(iii) I. Pollutes the environment /Produces poisonous gases when burnt✓1
II. Hydrolysis
III. Name:- Propylbutanoate ✓ 1
Structural formula:



$CH_3CH_2CH_2C-O-CH_2CH_2CH_3$✓ 1

5. (a) (i) To remove the large solid particles from water ✓ 1
(ii) Sedimentation ✓ 1
(iii) I. Cause the small suspended particles to settle down. ✓ 1
II. To kill germs/microorganisms/microbes Any ✓1

(b) (i) Permanent

(ii) Addition of Na_2CO_3 which precipitates Mg^{2+} as $MgCO_3$

OR

Use of ion exchange resin which will remove Mg^{2+} or distillation where $MgSO_4$ is left behind as residue. Any ✓ 1

(c) (i) Add excess ✓ ½ calcium oxide to dilute HCl/HNO_3 ✓ ½ filter to obtain the filtrate and add aqueous Na_2CO_3/K_2CO_3 ✓ ½ to the filtrate to precipitate $CaCO_3$ ✓ ½; wash the precipitate with distilled ✓ ½ water and dry it between filter papers ✓ ½

(ii) Used as chalk

- Used in the extraction of iron ✓ 1

6. (a) (i) P1 – All points plotted ✓ 1

C1 – Smooth curve ✓ 1

(ii) I. 5.4×10^{-3} mol dm^{-3}

II. Draw a tangent at t = $1\frac{1}{2}$ minutes

Hence rate = $\frac{9.4}{6.8}$

= 1.38×10^{-3} ✓1

(iii) Rate increases with increase in concentration ✓ ½ because the more the particles in solution the higher the frequency of collision between the particles. ✓ ½

(iv) See graph ✓ 1

Reason: At lower temperature, the particles have less K.E ✓ ½ hence frequency of collisions is reduced. ✓ ½

(b) No. of moles of $BaCl_2$ = $\frac{300 \times 2}{1000}$

= 0.6 moles ✓ ½

1 Mole $BaCl_{2(aq)}$ → 17.7kJ $mol^{-1}$of Heat Energy evolved.

0.6 moles $BaCl_{2(aq)}$ → ?

$\frac{17.7}{1}$ x 0.6 = 10.62 Kj ✓ ½

$\frac{750 \times 4.2 \times \Delta T}{1000}$ = 10.62kJ ✓ ½

$\Delta T = \frac{10.62 \times 1000}{750 \times 4.2}$

= 3.371 minutes

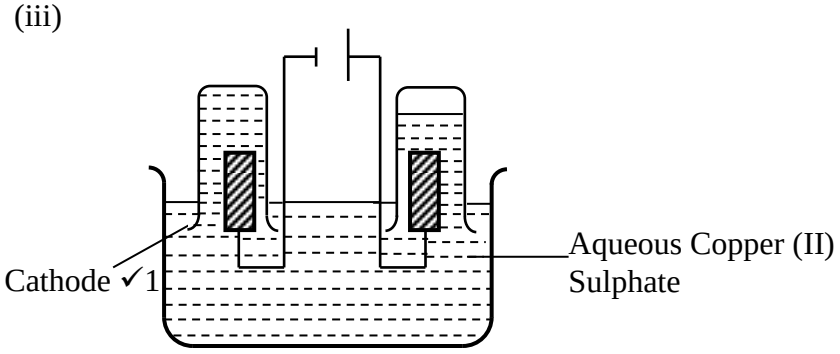
≅ 3.4 minutes (1 d.p) ✓ 1

7. (a) (i) Platinum/Graphite (Carbon) Any ✓ 1

(ii) SO_4^{2-} (aq) $Cu^{2+}_{(aq)}$ All ✓ 1

OH^- (aq) H^+(aq)

(iii)



(iv) $4OH^-_{(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)} + 4e^-_{(g)}$ ✓ 1

(v) The concentration of copper (II) ions in solution decreases ✓ ½ and the blue colour of the Copper (II) Sulphate solution becomes pale and finally colourless ✓ ½

(vi) Q = lt

= 2 x 4 x 60 x 60 ✓ ½

= 28000C ✓ ½

1 mole of gas → 4F

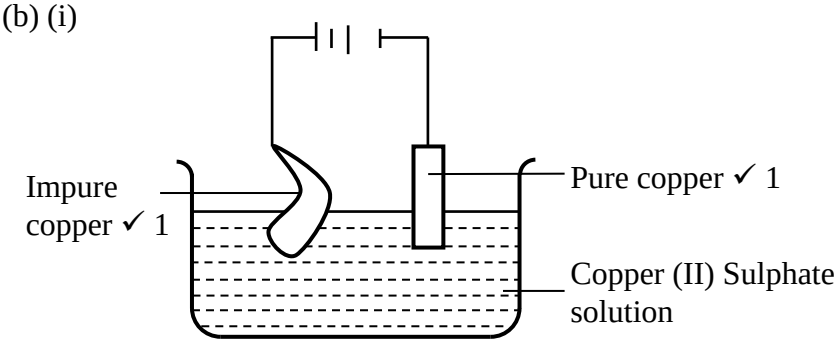
? → $\left(\frac{2\ x\ 4\ x\ 3600}{96500}\right)$F

$\frac{\frac{1}{4}x2x4x3600}{96500}$ moles ✓ 1

Volume of gas = $\frac{1}{4}$ x $\frac{2\ x\ 4\ x\ 3600\ x\ 24000}{96500}$ ✓1

= 1790.67cm^3 (2 d.p) ✓1

(b) (i)



(ii) – Electroplating

- Extraction of reactive metals
- Cathodic protection Any ✓ 1

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Kenya Certificate of Secondary Education (K.C.S.E.)

Chemistry 3

Practical

Time: 2 ¼ Hours

MARKING SCHEME

TABLE 1

Volume of water in the boiling tube	Temperature which crystals of solid P first appear (0C)	Solubility of solid P (g/100g water)
10	56.0✓1	60✓$^1/_2$
12	48.0✓1	50✓$^1/_2$
14	47.0✓1	42.85✓$^1/_2$
16	44.5✓1	37.5✓$^1/_2$

ii) Graph is a curve
Smooth curve-1 mark✓C1
Plotting all your points correctly✓P1-1 mark
Scale-graph must occupy ¾ S1of grid.

iii) Interpretation from the graph- (1 mark)✓1

PROCEDURE (II)

TABLE II	I	II	II
Final burette reading			
Initial burette reading			
Volume of solution R (cm^3) added			

1-complete table
1-decimals
1-accuracy
3 marks

Required value=12.5cm^3

i) Average volume of solution R used
$\frac{Add\ 3\ titre\ values}{3}$✓ $^1/_2$mk Give answer to 2 decimal places ✓$^1/_2$

ii) Using the given information
$concentration = \frac{25x2}{250}$✓ 0.2mol dm^{-3}✓1

iii) $No\ of\ moles\ base\ used = \frac{0.2x25}{1000}$

$No\ of\ moles\ of\ acid = \frac{0.2x25}{100} x \frac{1}{2} = (mole\ ratio 1:2\ mol)$

$= 0.0025 moles$

$concentration\ of\ acid = \frac{0.0025x1000}{Average\ titre\ value\ in\ (i)}$

iv) $MM = \frac{gl^{-1}}{molarity}$

$250cm^3 \longrightarrow 6g$

$1000cm^3 \longrightarrow$ **?**

$\frac{6}{250} x1000 = 24gl^{-1}$

$\therefore molar\ mass = \frac{24}{answer\ in\ (iii)}$✓1

v) $MxH_2O\ where\ M = 90$

$\therefore xH_2O = Answer\ in\ (iv) - 90$

$x = \frac{Answer\ in\ (iv) - 90}{18}$✓ 1

Approximately 2

PROCEDURE III

	I	II
$T_1{}^OC$	1decimal 0.5 or 0.0	1 decimal place 0.0 or 0.5
$T_2{}^OC$	1 decimal place 0.0 or 0.5	1 decimal place 0.0 or 0.5
$T_3{}^OC$	1 decimal place 0.0 or 0.5	1 decimal place 0.0 or 0.5

a) $\Delta T\ (^oC) = T_3 - \frac{T1+T2}{2}$

b) $\Delta H = \left(\frac{m\Delta TC}{1000}\right) kJ$

Where $m = 25 + 25 = 50cm^3$

$\Delta T = value\ in\ answer\ (a)$

E-$AlCl_3$

2. You are provided with solid E. (carry out the tests below and record your observations and inferences in the space provided.
   a) Place about one-half of the solid E in any test tube. Heat gently then strongly and test any gas produced with red and blue litmus papers.

Observation	Inferences
-White fumes which turns blue litmus red and red litmus remains red. -Colourless liquid formed on the cooler par of test tube. (2 marks)	-Acidic gas produced. -Is a hydrated salt. (1mark)

b) Place the rest of solid E in a boiling tube. Add about $10cm^3$ of distilled water. Shake well and use $2cm^3$ portions for each of the tests below.

i) To one portion add solution Q (sodium hydroxide) drop wise until in excess.

Observations	Inference
White precipitate that dissolves in excess (1 mark)	Al^{3+}, Pb^{2+}, Zn^{2+} present (1 mark)

ii) To the second portion, add ammonia solution drop wise until in excess.

Observation	Inferences
White precipitate Insoluble in excess (1 mark)	Al^{3+}, Pb^{2+} present

iii) To the third portion, add $1cm^3$ of $BaCl_2$ solution.

Observation	Inferences
No white precipitate formed (1 mark)	SO^{2-}_4,SO^{2-}_3,CO^{2-}_3 absent (1 mark)

iv) To the fourth portion add two drops of aqueous lead (II) nitrate and heat the mixture to boiling.

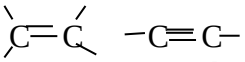
Observation	Inferences
White precipitate is formed and dissolves on warming. (1 mark)	Cl^- present (1 mark)

F-oxalic acid

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

a) Describe the appearance of solid F white crystalline solid

b) Place about one-third of solid F on a metallic spatula and burn it in a Bunsen burner flame.

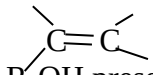
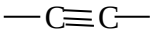
Observation	Inferences
Solid melts and burns with smoky flame (1 mark)	 Present (1 mark)

c) Dissolve the remaining amount of solid F in about 10 cm3 of distilled water in a boiling tube and shake well. Divide the solution into three portions.

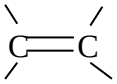
i) To the first portion add all of the solid sodium hydrogen carbonate provided.

Observation	Inferences
Effervescence occurs with production of a colourless gas. (1 mark)	 or H^+ present

ii) To the second portion, add three drops of acidified potassium (VI) solution and warm.

Observation	Inferences
Purple potassium Magnate (VII) is decolourised (1 mark)	  R-OH present. (1 mark)

iii) To the third portion, add five drops of bromine water.

Observation	Inferences
Bromine water decolourised (1 mark)	 — C≡C — present (1 mark)

iv) Describe how you can find the PH of solid F above. (1 mark)

Dissolve the solid in distilled water to form a solution.

To the solution, add a few drops of universal indicator and match the colour produced with PH chart and record its PH.