**FORMFOUREXAMINATION**

**032CHEMISTRY1**

**MARKINGSCHEME2023**

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| C | D | D | C | D | C | D | C | D | A |

**(@1marks)**

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| --- | --- | --- | --- | --- | --- |
|  | ii | iii | iv | v | vi |
| E | F | K | J | A | C |

**(@01mark)**

1. (a)(i)16O10,19F10,23Na10,24Mg10**(@01/2mark)**

(ii)Theirelectronicconfigurationintheirionsis2:8

Theirelectronicconfigurationintheiratoms

8016=2:6

9F19=2:7

10Ne20=2:8**(@01/2mark)**

11Na23=2:8:1

12Mg24=2:8:2

V2O5

(b)(i)2SO2(g)+O2(g)2SO3(g)+Heat**(01mark)**

(ii)H2SO4(l)+SO3(g)H2S2O7(l)**(01mark)**

(iii)Contactprocess**(01/2mark)**

(iv)

* Itisusedintheextractionofmetalseg.Toremoverust.**(@01/2anytwopoints)**
* Itusedtointhemanufactureofaluminiumsulphate.
* Itusedintherefiningofaluminium
* Itusedintheleadacid(car)batteries.
* Itusedasadehydratingagentsinitsconcentratedform
* Itusedinthemanufactureofawiderangeofpigments.

1. (i)Unsaturatedsolution,becauseitdissolvedmoresoluteatagiventemperature

**(02marks)**

1. Saturatedsolution,becausewaterlostitsabilitytocontinuedissolvingthesaltatroomtemperature**(02marks)**
2. Supersaturatedsolution**(02marks)**
3. Separatingcertainmixtureinthelaboratory**(1.5marks)**

Extractingsomeminerals,suchascommonsalt.**(1.5marks)**

1. Threeapplicationofseparationofmixtures**(@01/2mark)**

* Purificationofwater
* Manufactureofalcohol
* Inmedicaldiagnosisandstudies
* Inextractionofcommonsalt
* Extractionofcertainedibleoilsfromseeds

(b)Solution

Data

VolumeofbaseVb=20.0cm3

ConcentrationofNaOH=8.0g/dm3**(01/2mark)**

Massofdibasicacid(H2X)=0.18g

Chemicalreaction

2NaOH+H2X→Na2X+2H2O**(01mark)**

But;Molarity=Concentrationg/dm3

Molarmassg/mol

Molarity=8.0g/dm3

40g/mol

=0.2M**(01/2mark)**

But;Molarity(M)=Numberofmole(n)

Volume(dm3)

M=n/v**(01/2mark)**

n=Molarity×Volume(dm3)

=0.2x0.02

=0.004mol**(01.5mark)**

Fromchemicalequation;

2NaOH+H2X→Na2X+2H2O

2molNaOH→1molH2X

0.004molsNaOH→Y?

Y=0.002molofH2X**(01.5mark)**

From;n=mass/molarmass

Molarmass=m/n

=0.18g/0.002mol

=90g/mol

Therefore;therelativemolecularmassofdibasicacidis90**(02mark)**

1. a)–Faraday’sfirstlawofelectrolysisstatesthat,“Themassofasubstancedepositedorliberatedduringelectrolysisisdirectlyproportionaltothequantityofelectricitypassedthroughtheelectrolyte.**(1.5Mark)**

-Faraday’ssecondlawofelectrolysisstatesthat,“Whenthesamequantityofelectricityispassedthroughsolutionsofdifferentelectrolytes,themassofthesubstanceliberatedordepositedatelectrodeisdirectlyproportionaltothechemicalequivalentofthesubstance.**(1.5Mark)**

b)Datagiven

Quantityofelectricity(Q)=9650C

MolarmassofAg=108g/mol

G.V.M=22.4dm3

1F=1MolofAg=108g/mol**(0.5Mark)**

1F=96500C

96500C=108g/mol **(0.5Mark)**

9650C=?

108X965096500=10.8g.

MassofSilver(Ag)=10.8g**(01Mark)**

4OH-(aq)+O2+2H2O+4e-(LiberatedatAnode)**(01Mark)**

4e-=4F

4e-=1molofO2atSTP.(foranygas)

1mol=22.4dm3**(01Mark)**

4(96500C)=22.4dm3ofO2

9650C=?

9650Cx22.4dm34(96500C)=0.56dm3

VolumeofoxygenliberatedatSTP=0.56dm3or560cm3**(02Mark)**

1. Asanacid
2. Dehydratingagent
3. Asanacid
4. Asanoxidizingagent**(09marks)**
5. Dehydrating
6. Dehydrating
7. Asanacid
8. a)i.Moleconcept:istheamountofsubstancewhichcontainsasmanyparticulateentities(atoms,ions,molecules)astherearecarbonatomsin12gofcarbon12.**(02mark)**
9. Molarvolumeofgas:isthevolumeoccupiedbyonemoleofallgasesats.t.pwhichisequalto22.4dm3.**(02mark)**

**Data:**

MassofH2SO4=9.8g

Avogadro’snumber(LA)=6.02x1023**(01mark)**

**Required:**

Numberofions=?

Equation:H2SO4(aq)→2H+(aq)+SO42-(aq)

**Calculations:**

MolarmassofH2SO4=(2x1)+32+(16x4)

Molarmass=98g/mol**(01mark)**

Numberofmoles(n)=massmolar mass

n=9.8g98g/mol

n=0.1mol**(01mark)**

Fromtheequation

1moleofH2SO4→3molesofionsofH+ANDSO42-

0.1molesofH2SO4→?

Numberofmolesofions=0.3mol.**(01mark)**

**From**N=nLA

N=0.3X6.02X1023

IONSPRESENT=1.81X1023ions**(01mark)**

1. a)Sodiumisextractedbytheelectrolyticreductionofthepurifiedmoltenrocksalt(sodiumchloride)**(01mark)**

Theextractionprocessofsodium(electrolyticreduction)ismainlycarriedoutintheDown`scellusingsteel(iron)cathodeandgraphiteanode**(01mark)**

thematerialsrequiredaresodiumchloride(electrolyte)andcalciumchloride,theroleofcalciumchlorideistolowerthemeltingpointofsodiumchloride,fromabout8010Cto6000C,CaCl2doesnotsplitup**(01mark)**

Chlorideions(Cl-)movetotheanodewhilesodiumions(Na+)movetothecathode**(01mark)**

Atthecathode,sodiumions(Na+)aredischargedandsodiumisformed

Na++e- Na(s)**(01marks)**

Attheanode,chlorideions(Cl**-**)aredischargedandchlorinegasisformed

2Cl- CL2+2e-**(01mark)**

Thecylindricalmetalgauzeisdesignedtokeepthesodiumandchlorineapart,otherwisetheywouldrecombine.

Thelargegraphiteanodeisusedtofacilitatemaximumoxidationofchlorineionstochlorinegasandtomaximizetheformationofsodiummetalatthecathode

Thediagramfortheelectrolysisofsodium(downcell)

**(Drawingandlabelingatleast5parts@01=(05marks)**

(b)

(i)Manufactureofsodiumcyanide(NaCN)whichisemployedintheextraction

ofgold.

(ii)Manufactureofsodamide(NaNH2)andsodiumperoxide(Na2O2).

(iii)Usedinreductionoftitanium(iv)chloridetothemetalbyheat;

TiCL4(l)+4Na(s)Ti(s)+4NaCl(s).

(iv)Usedasacoolantfornuclearreactors.

(v)Analloyofsodiumandleadisusedinthemanufactureoftetraethyllead,and

antiknockadditiveusedinpetrol.

Pb(s)+4Na(s)+4C2H5Cl(g)4NaCl(s)+Pb(C2H5)4(l)**(@01marks).**

1. i.LandpollutionisthedegradationoftheEarth’slandsurfacethroughhumanactivities **(01mark)**

**CausesofLandpollution(@01mark,anytwo)**

* Solidwastee.gagriculturalwaste,miningwaste,chemicalwastefromindustries,waste informofbiomass.
* Deforestation
* Pooragriculturalmethods.
* Illegaldumpingofwastes(toxicwastestotheland
* Oilspills.
* Garbagedisposal

**Effects(@01mark,anytwo)**

* Createhealththreattopeopleandotherlivingorganisms
* Environmentbecomesugly
* Attracthouseholdpests
* Damageterrestriallife

**Precautions(@01mark,anytwo)**

* Recyclingandre-useofwastematerials
* Usingdesignateddumpingsites
* Formulatingandenactingpoliciesandlawsaboutenvironmentalconservation
* Creatingawareness

ii.Eutrophicationisanenrichmentofwaterbynutrients,saltsthatcausesstructuralchangestotheecosystemsuchasincreasedproductionofalgaeandaquaticplants,depletionoffishspeciesandgeneraldeteriorationofwaterquality**(01mark)**

**Causes(@01mark,anytwo)**

* Useoffertilizerscontributetotheaccumulationofnutrients
* Dischargeofwastewaterintowaterbodies
* Reductionofself-purificationcapacity

**Effects(@01mark,anytwo)**

* Abundanceofparticulatesubstances(phytoplankton,bacteria,fungianddebris)
* Abundanceofinorganicchemicalssuchasammonia,nitratesandhydrogensulphidesthatinducetheformationofharmfulsubstance.
* Abundanceoforganicsubstancesthatgivesthewaterdisagreeableodorsortastes
* Disappearanceofqualityfish
* Possibleformationoftoxicalgaewithpotentialdamagetothepopulationandanimalsdrinkingtheaffectedwater
* Prohibitionoftouristicuseofthelakeduetoboththefoulodor

**Precaution(@01mark,anytwo)**

* Improvementofthepurifyingperformanceofwastewatertreatmentplantstoreducenutrientsconcentration
* Rationalizationofagriculturaltechniquethroughproperplanningoffertilization.
* Removalandtreatmentofdeeperwaterincontactwithsediments.
* Conclusion

**(01mark)**

1. Volumeofhydrogengasproduced=8400cm3

Atomicmassofcopper=63.5

G.M.V=22.4dm3mol-1

Electrodereactionfordischargeofchlorinegas:

2H+(aq)+2*e-*→H2(g)**(01Mark)**

Theequationsuggestthat2FaradayswillliberateonemoleofH2gas.

Therefore,

2Fproduces1molofH2(g)

Then,

2Fproduces22400cm3ofH2(g)

*x*?Fproduces8400cm3ofH2(g)**(03Marks)**

*x*=8400cm3x2F=0.75F

22400cm3

Therefore,***0.75Faradays***ofelectricitywerepassedthroughthetwosolutionsinseries**(01Mark)**

Volumeofoxygen:

4OH-(aq)→2H2O(l)+O2(g)+4*e-***(01Mark)**

Therefore,4Faradayswouldliberateonemoleofoxygengas

4Fproduces1molofO2(g)

Then,

4Fproduces22.4dm3ofO2(g)

0.2232Fproducesy?dm3ofO2(g)**(03Marks)**

y=0.75Fx22.4dm3=4.2dm3

4F

Thevolumeofoxygenwouldbeproducedis***4.2dm3*(01Mark)**

Thedischargeequationforliberationofcopper:

Cu2+(aq)+2*e-*→Cu(s)**(01Mark)**

2Faradayswouldliberateonemoleofcopper

Therefore,

2Fproduces63.5gofcopper(Cu(s))

0.75Fproduces*x*?gofcopper(Cu(s))**(03Marks)**

*x*=0.75Fx63.5g=7.10g

2F

Themassofcopperproducedwas***23.8125g*(01Mark)**