Name: .... Index No ....

School: .... Class .

Date: .

233/1

CHEMISTRY THEORY

PAPER 1

TIME: 2 HOURS

KASSU JET EXAMINATIONS

JANUARY 2021

Instructions to Candidates

(a) *Write your name and index number in the spaces provided above.*

(b) *Sign and write the date of examination in the spaces provided above*

(c) *Answer **ALL** the questions in the spaces provided in the question paper*

(d) *KNEC Mathematical tables and electronic calculators may be used for calculations*

(e) *All working **MUST** be clearly shown where necessary*

(f) *This paper consists of 12 printed pages*

(g) *Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing*

(h) *Candidates should answer the questions in English*

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1—29	80	

This paper consists of 12 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

1. Study the diagram below then use it to answer the questions that follow.

a) Draw the wooden splint at the end of the experiment. If it was slipped then removed. (1 mark)

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C'havwveA[Ba. t zo.a

b) Explain the appearance of the wooden splint in (a) above. (2 marks)

.Chget..pact... ts. hettst....z..5»...9.£. . .resat.s f..Ce»p t

Coy.bet~_..gk..ggses... ! i!e-.. = ckax..ed....z.ens........is....g..<.£(t

...4. l.~~.~r.l4.~ (.Q.'.'. k>.~½~'~.. ~

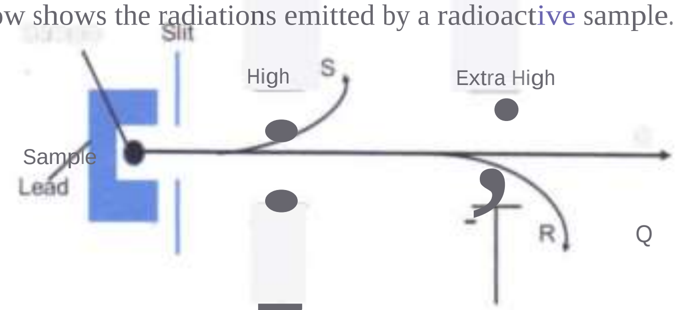
2. (a) The half-life of ! 'Mis 7 days. Determine the mass of remaining if 1 O0g decayed in 35 days. (3 marks)

N~:..1..~'.f.. :~iff........ ~ - = too 3 ~..........

_:. _±.5.sake _ (f .tee. _ 3 .1359. . !::. –

_ ±7Rs +

(b) The diagram below shows the radiations emitted by a radioactive sample. (d _ 3R.125



7

(i) Identify radiation particles S and R. (I mark)

S. 6et..(8).... . rites.... . . . .

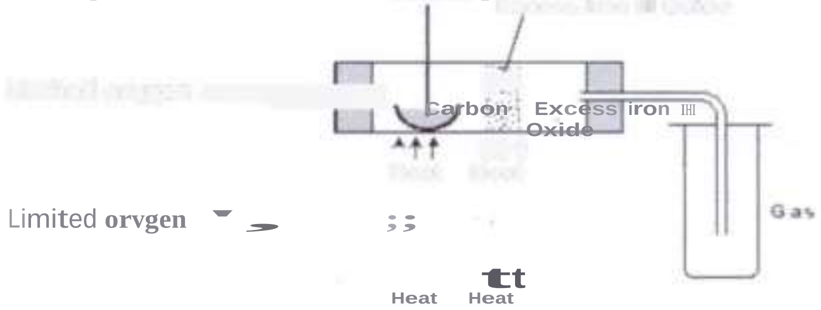
R.....:t-~.~.\~ ~~.~~.:

(ii) Which emission causes most harm to human cells. Give a reason. (1mark)

Alpha: Has greater ionising effect

3. a) Starting with copper metal, describe how a solid sample of copper (II) carbonate can be prepared. (3 marks)

4. The set-up below was used to obtain a sample of iron.



Write two equations for the reactions which occur in the combustion tube. (2 marks)

$Fe_2O_3(s) + 3CO(g) \longrightarrow 2Fe(s) + 3CO_2(g)$

5. Below are the bond dissociation energies of some elements.

Bond	Bond dissociation energy
C−C	343 kJ mol^{-1}
C−H	414 kJ mol^{-1}
H−H	435 kJ mol^{-1}
C=C	612 kJ mol^{-1}

Use this information to calculate the heat of reaction for (3 marks)

$C_2H_4(g) + H_2(g) \rightarrow C_2H_6(g)$

ΔH = BBE + BFE

C=C = 612
C−H = 4/6X + 165G

C−C = 343
C−H = 410XG = 2424
+ 2824

ΔH = −73+882

− 2103 Jlss

6. Sulphur (IV) oxide is oxidized catalytically to sulphur (VI) oxide in the reaction.

$2SO_2 + O_2 \rightarrow 2SO_3$ ΔH = −197kJ

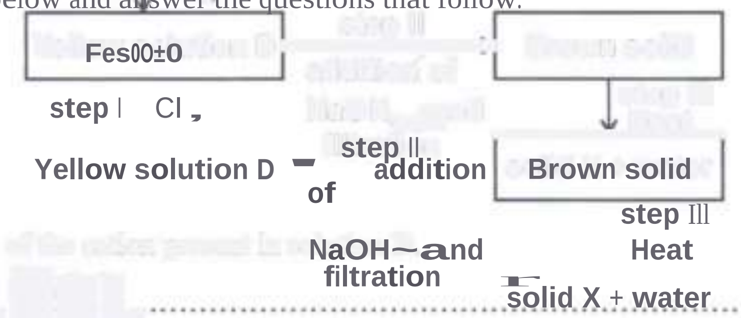
a) What information about the reaction is given by ΔH=-197kJ? (1 mark)

....

b) Name one catalyst that can be used in this reaction. (1 mark)

..........V... oxf...

7. Study the scheme below and answer the questions that follow.



a) Write the formula of the cation present in solution D. (1 mark)

..................F...i...)i

b) What property of chlorine is shown in step 1. (1 mark)

............OX!'~(~' ~~ ....-. :~¼t.:

war-7‰.7715,,

8. 0.63g of lead powder were dissolved in excess nitric (V.) acid to form lead (II) nitrate solution. All the lead (II) nitrate was then reacted with sodium sulphate solution.

a) Write an ionic equation for the reaction between sodium sulphate solution and lead (II) nitrate solution. (1 mark)

...........PP~:...±....$9.~............j?...PbSO+...

b) Determine the mass of the lead salt formed in the reaction in (a) above (Pb = 207, S = 32, O 16) (2 marks)

MA«,p-0S 0· 0030 if-rvU 4'

VLUU ....D1:⁻,·~01

a.O

~·1·f..b !Pi:~?.:~.'.~~?~ 'f...

O O{gO as = 3lg,

9. Use the cell representation below to answer the questions that follow.

€r, Cr~"Fei, Fe

a) Write an equation for the cell reaction. (1 mark)

......Ff::.+...t..fc............J?...... G~~T··±····F·~:;...............................

b) If the emf of the cell is 0.30V and the E" value for Fe'' / Fes is -0.44V. Calculate the E" value for Cr/Cr%a (2marks)

E E%-F%

0·30V = −0.41−FF0'

10. An element Q has a relative atomic mass of 88. When a current of 0.5A was passed through the fused chloride of Q for 32 minutes and 10 seconds, 0.44g of Q were deposited at cathode. Determine the charge on the ion of Q. (1 Faraday = 96500 coulombs) (3 marks)

Mass = $\frac{MIt}{ZF}$

$0.44g = \frac{88 \times 0.5 \times 1930}{96500 z}$

$\frac{0.44}{z} = 0.88$

$0.44z = 0.88$

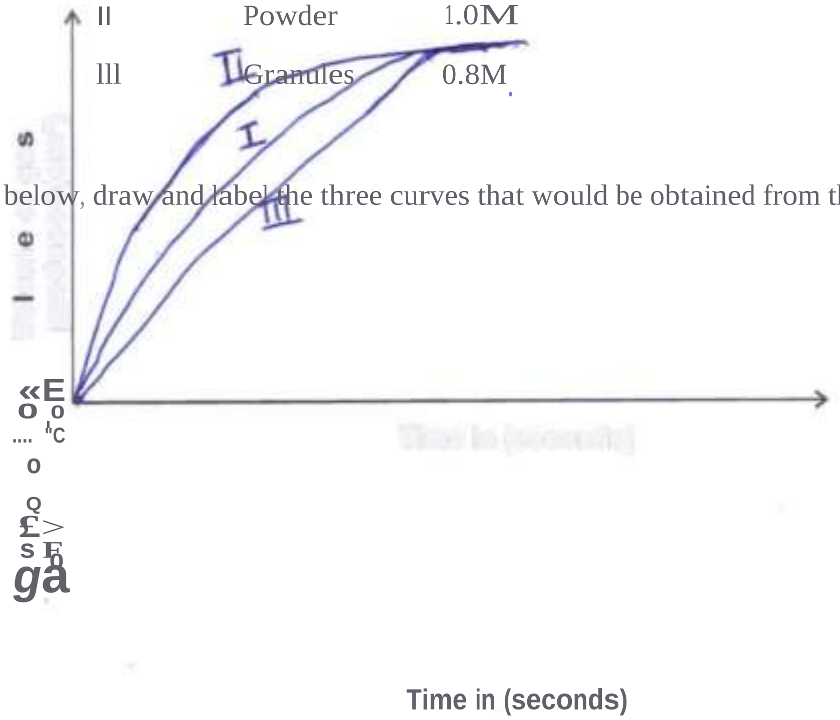
$z = +2$

Alternatively

11. The table below gives three experiments on the reaction of excess sulphuric (VI) acid and zinc done under different conditions. In each case the volume of gas liberated was recorded at different time intervals.

Experiment	Form of Zinc	Sulphuric (VI) acid
I	Powder	0.8M
II	Powder	1.0M
III	Granules	0.8M

On the axes below, draw and label the three curves that would be obtained from the results above. (3 marks)



12. a) Starting with red roses, describe how a solution containing the red pigments may be prepared? (2marks)

...... ~(1~~~ Y.0.$:~f Y~{~~ R~~|~.~ M.—

.....: AA_eg.nee.....ts.Asses.he..reRg.et<..........

......:Fkte.le. obtmi-....x=.A.p.gs&..Se!he-.e-... .lhca.t:

b) How can the solution be shown to be an indicator. (1 mark)

...A.A..chg....sk.t....R'3est.lo...IXt«.t..1re..£.cke •
cs<. It uh cto <are Colaw o c&kc k
kK@.at
la#Cao Cclox o- Iccec.

13. The table below provides data on the successive ionisation energies of carbon.

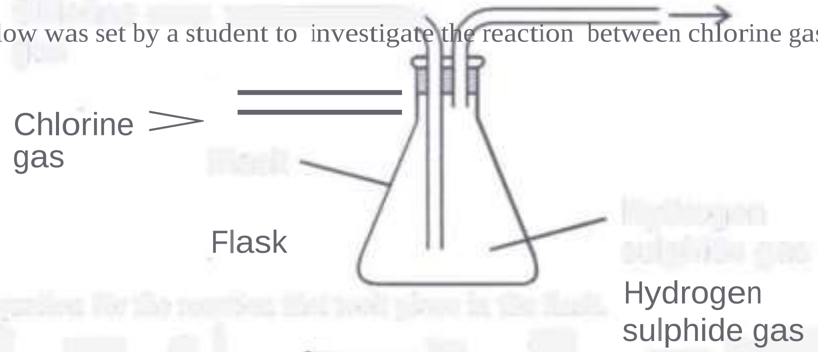
Ionisation numbers	1st	2nd	3rd	4th	5th	6
Ionisation energy (kJ/mol)	1090	2350	4610	6220	37800	47300

a) Explain why each ionisation energy increase in nature. (2 marks)

.RfHe. ls...Ye . eye.t.ck...gs..eleck<en...ltn.....xes\....Mc.Jes.x
.Cke-.se.......aeA.....tte....Ye.chi . .....el=cc.........[5>>lg.......

b) Write an equation for the 5th ionisation energy of carbon. (1 mark)

14. The figure below was set by a student to investigate the reaction between chlorine gas and hydrogen sulphide gas.



a) Write an equation for the reaction that took place in the flask. (1 mark)

..........8. S :-t ~|. t?.: S. -:-+.-.2.±±.c L
2 D
......................:!~ ~5:. ~! ~'1.)

b) What observation was made in the flask? (1 mark)

..........7.~\LQY:J 4~f.~:~ 4 →:~).p.h.~:<. t~ ~X:~J..

18. (a) Give Bronsted and Lowry definition of an acid (1mk)

An acid is a proton donor.

ifferent id : ks)

19. When a hydrated sample of $CaSO_4.xH_2O$ was heated until all water was lost, the following data was recorded

Mass of crucible	=	30.296 g
Mass of crucible + hydrated salt	=	33.111g
Mass of crucible + anhydrous salt	=	32.781g

Determine the empirical formula of the hydrated salt. ($CaSO_4$=136, H_2O=18)

20. Describe a chemical test used to distinguish butane from butene in the laboratory. (2marks)

21. The table below gives the atomic numbers of elements W, X, Y and Z.

Element	W	X		Z
r	14	17		19

a) Name the type of bonding that exist in the compound formed when X and Z reacts (1mark)

b) Select the letter representing the strongest reducing agent. Give a reason for your answer. (2mks)

Z. Has largest atomic radii lowest ionisation energy.

e) What precaution should be taken in carrying out the experiment? (1 mark)

15. A certain carbonate, QCO_3, reacts with dilute hydrochloric acid according to the equation given below.

$$QCO_{3(s)} + 2HCl_{(aq)} \rightarrow QCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$

If 1 g of the carbonate reacts completely with 20cm³ of 1 M hydrochloric acid. Calculate the relative atomic mass of Q.(C= 12.0, O=16.0) (3marks)

$\frac{20 \times 1}{1000} = 0.02$ moles

16. When bismuth (III) chloride is added to water, a reaction occurs and a white precipitate forms as shown below.

$BiCl_{3(aq)} + H_2O_{(l)} \rightleftharpoons BiOCl_{(s)} + 2HCl_{(aq)}$

What would be the effect on the amount of the precipitate formed if sodium hydroxide solution is added to the equilibrium mixture? Explain your answer. (2marks)

(b) If a gaseous hydrocarbon, C_2H_x required 30cm³ of oxygen for complete combustion. If 20cm³ of steam and 20cm³ of carbon (IV) oxide were produced, what is the value of X? (2 marks)

$\longrightarrow 2CO_2 + 2H_2O$

C–{

— — — — — – — — –(8

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(b) Di ... trated ac ... of ... d

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	W		Y
	14		16

20. Describe a chemical test used to distinguish butane from butene in the laboratory. (2marks)

b) Select the letter representing the strongest reducing agent. Give a reason for your answer. (2mks)

It has largest atomic radius lowest ionisation energy.

21. The table below gives the atomic numbers of elements W, X, Y and Z.

a) Name the type of bonding that exist in the compound formed when **X** and **Z** reacts. (I mark)

....h\:~

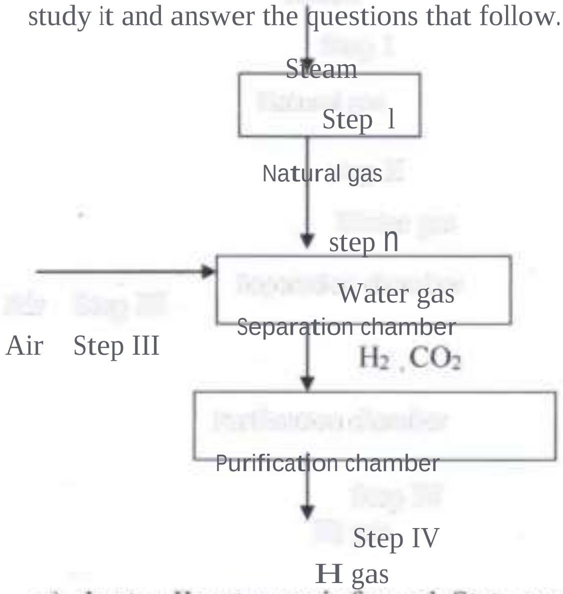
22. In an electrochemical cell, the standard hydrogen electrode uses platinized platinum. State **three** functions of the platinized platinum. (3 marks)

Af.~ as. ..ai,, ...a.r....WP.\. c9Ue— l?...Jt.'?:- Ji[H.'.eif,J ...:\''½>.~~

–....[lad........6.#a.ts....a.£e.....9...skk....d.seetle...9.tteela..h.see.pl

.•.4@12.£...Ga.a.a.....e.lg.sh.ck....eeks.gr....de...th.....ekR!a1....Se!.t:...........

23. The flowchart below shows the scheme for extraction of Hydrogen from hydrolysis of natural gas, study it and answer the questions that follow.



a) **In step II water gas is formed. State one use of water gas.** **(1marks)**

in fuel in cells ....

b) When air is added in step III CO is converted to CO name one chemical substance that can be used to separate CO from H in step IV (1marks)

... COLl~0.- ½d~xl: JJ.- ....

[redacted]ale use of Hydrogen gas formed.)

rr.cf. ....

24. Aluminium is obtained from the ore with the formula $AlO.\ 2HO$. The ore is first heated and refined to obtain pure aluminium oxide (Al_2O_3). The oxide is then electrolysed to get Aluminium and oxygen gas using carbon anodes and carbon as cathode.

i) Give the common name of the ore from which aluminium is extracted. (1 mark)

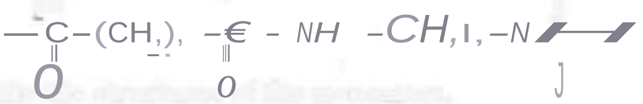
....

ii) What would be the importance of heating the ore first before refining it ? (1 mark)

iv) Why are the carbon anodes replaced every now and then in the cell for electrolysing aluminium oxide? (1 mark)

....

26. Nylon polymer has the structure below.



i) Determine the structures of the monomers. (2mks)

....

ii) State the type of polymerization. (1mk)

....

27. (a) Define the term solubility. (1 mark)

....

b) The following were the results obtained in an experiment to determine solubility of potassium nitrate at room temperature.

Mass of evaporating dish = 14.32 g

Mass of evaporating dish+ saturated solution= 35.70 g

Mass of evaporating dish + salt (residue) = 18.60 g

Calculate the ... (2 marks)

28. Describe a simple laboratory experiment that can be used to distinguish between sodium sulphide and ... (2 marks)

29. (a)Give **one** reason some of the laboratory apparatus are made of ceramics. **(1 mark)**

(b) Name **two** apparatus that can be used to measure approximately 75 cm? of dilute sulphuric (VI) acid. **(2 marks)**

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