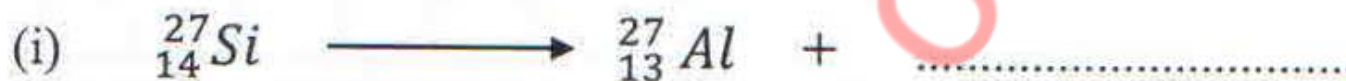


UNEB UACE CHEMISTRY PAPER 1 2017

SECTION A

1. a) Complete the following equations for nuclear reactions.



b) In an experiment, the rate of radioactive decay of bromine decreased by 25% in 96 minutes. Calculate the half life of bromine.

2. An alkene R, diffuses through a porous partition in 2 minutes. Under similar conditions, the same volume of oxygen diffuses in 1.75minutes.

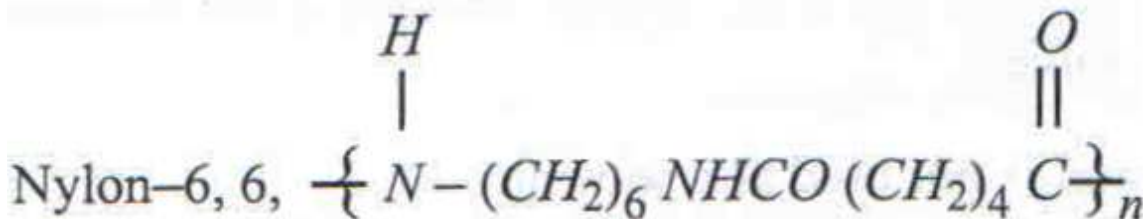
- a) i) Calculate the formula mass of R.
- ii) Determine the molecular formula of R.
- b) Write equations to show how R can be synthesized from propanone.

3. a) In the manufacture of sulphuric acid, sulphur trioxide is not dissolved in water, bit another solvent.

- i) State why water is not used as a solvent
- ii) Write equation(s) to show the formation of sulphuric acid from sulphur trioxide.
- b) Write equation for the reaction between sulphuric acid and hydrogen bromide.

4. a) State one colligative property of dilute solution other than depression of freezing point or elevation of boiling of a solvent.

b) Ethane -1-2 dio $\text{HOCH}_2\text{CH}_2\text{OH}$, is used as an antifreeze for water in car radiators. Calculate the mass of ethane -1-2- diol that should be added to 1 kg of water prevent it from freezing at -10°C .
(Freezing point depression constant for water = $1.86^\circ\text{C kg mol}^{-1}$)

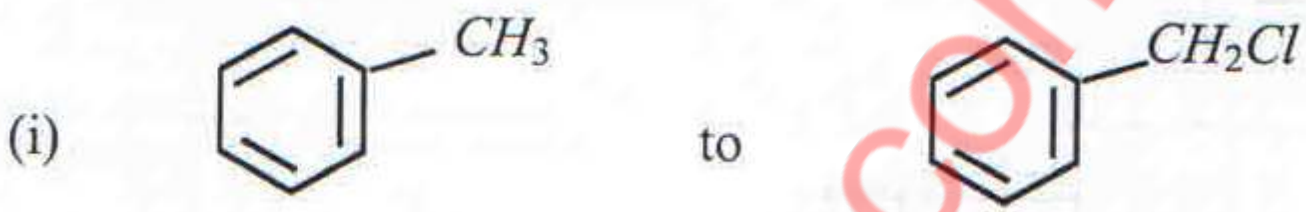


5. _____ is a synthetic polymer formed by condensation polymerisation.

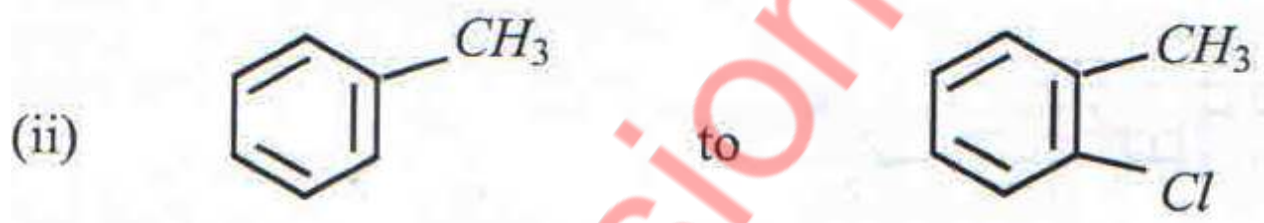
- a) State what is meant by the term condensation polymerisation
- b) Write the structural formulae of the monomers of nylon -6, 6.
- c) Name:
- one natural polymer that is formed by condensation polymerisation.
 - the monomers of the polymer in (c) (i).
- d) State one use of the polymer you have named in (c) (i)
6. a) State two properties in which chromium behaves as a transition element.
- b) Write the equation for the reaction that takes place when chromium (III) sulphate is dissolved in water.
- c) Magnesium ribbon was added to a solution of chromium (III) sulphate.
- State what was observed.
 - Write the equation for the reaction that took place.
7. The graph below shows how total vapor pressure of a mixture of water and nitrobenzene varies with temperature.



- a) State the temperature at which the mixture boils at 760mmHg pressure.
- b) The partial vapor pressure of nitrobenzene at the boiling point of the mixture is 20mm Hg. Calculate the percentage of nitrobenzene by mass that will be obtained when the mixture is steam distilled at normal atmospheric pressure. (H=1; C=12; N=14; O=16)
8. a) State the condition(s) under which the following conversions can be effected.

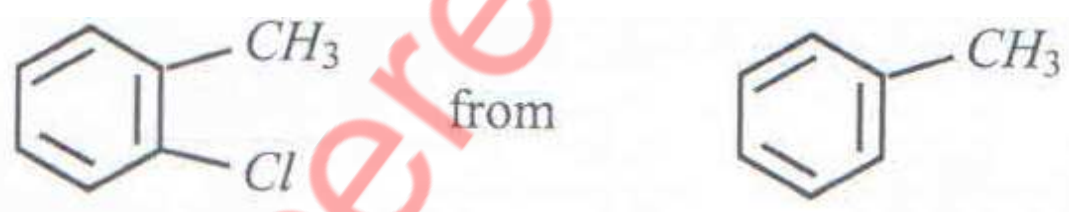


Conditions



Conditions:

b) Write a mechanism for the reaction leading to the formation of



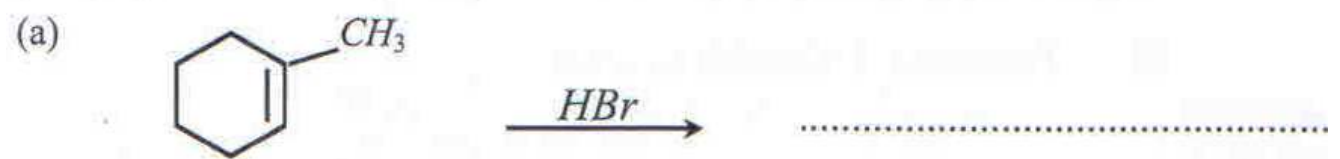
9. Explain the following observations:

- a) Silicon (IV) chloride is hydrolysed by water whereas carbon tetrachloride is not.
- b) Lead(IV)chloride exists but lead(IV) bromide does not.

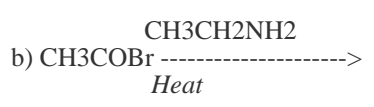
SECTION B

Answer six questions from this section

10. Complete each of the following equations and write the mechanism for the reaction.



Mechanism:



Mechanism:

KCN/H⁺
c) HCHO----->

Mechanism:

11. a) State what is meant by the term buffer solution

b) Calculate the pH of the solution formed when 0.61g of benzoic acid is dissolved in 1 dm³ of a 0.02M sodium benzoate.

(K_a of benzoic acid = 6.3 x 10⁻⁵ mol dm⁻³)

c) Explain what would happen to the pH of the solution in (b) if a few drops of the following reagents were added:

i) Potassium hydroxide solution

ii) Hydrochloric acid.

12. a) When 0.1g of aluminum chloride was vaporized at 350⁰C and pressure of 1 atmosphere, 19.2cm³ of vapor was formed.

i) Calculate the relative molecular mass of aluminum chloride.

ii) Write the molecular formula of aluminum chloride in the gaseous state at 350⁰C. (Al = 27; Cl =35.5).

b) Aluminum chloride is normally contaminated by traces of iron (III) chloride.

i) Name one reagent that can be used to detect the presence of iron (III) ion in a contaminated solution of aluminum chloride.

ii) State what would be observed if the contaminated aluminum chloride solution was treated with the reagent you have named in (b) (i).

iii) Write equation for the reaction leading to the observation you have stated in (b) (ii)

c) Water was added drop wise to aluminum chloride.

i) State what was observed

ii) Write equation for the reaction that took place.

d) State one use of aluminum chloride in organic synthesis.

13. a) Draw the structure and name the shape of each of the species in the table below.

Species	Structure	Shape
BF ₃		
SnCl ₂		
ClO ₃ ⁻		

b) Write equation for the reaction between:

i) boron trifluoride and ammonia

ii) acidified potassium iodide solution and aqueous sodium chlorate (V) solution

iii) tin(II) chloride and iron(III) ions.

14. a) Write:

- i) equation for the ionization of methanoic acid in water.
- ii) the expression for the acid dissociation constant K_a , for methanoic acid.
- a) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table below.

Electrolyte	Molar conductivity at infinite dilution ($\text{Scm}^2 \text{mol}^{-1}$)
Sodium chloride	113.0
Sodium methanoate	101.0
Sodium hydroxide	225.2
Hydrochloric acid	397.8

Calculate the molar conductivity of methanoic acid at infinite dilution

c) The molar conductivity of a 0.05M methanoic acid solution is $24.318 \text{ Scm}^2 \text{mol}^{-1}$ at 25°C .

Calculate the:

- i) degree of ionization of methanoic acid at 25°C
- ii) dissociation constant K_a of methanoic acid at 25°C

15. Name one functional group that can be identified using each of the following reagents. In each case state what would be observed and write equation for the reaction that would take place:

a) Bromine water

Functional group:

Observation

Equation:

b) 2,4 – dinitrophenyl hydrazine.

Functional group:

Observation

Equation:

c) Sodium carbonate

Functional group:

Observation

Equation:

16. During the extraction of copper from copper pyrites, copper pyrites is crushed and agitated with water/oil mixture. Compressed air is bubbled through the mixture which is then filtered, roasted and finally impure molten copper is obtained.

a) State the role of

- i) oil
ii) compressed air

b) Write equation for the reaction that occurs when copper pyrites is roasted.

c) Explain briefly how impure copper can be refined.

d) Explain why it is advantageous to have a sulphuric acid manufacturing plant near a copper extraction plant.

17. a) State what is meant by the term:

- i) order of a reaction
ii) Half life of a reaction

b) The table below shows the kinetic data obtained for hydrolysis of methyl ethanoate in acidic media.

$[\text{CH}_3\text{COOCH}_3]$ (mol dm ⁻³)	0.241	0.161	0.109	0.073	0.046	0.034

Time (minutes)	0	60	120	180	240	320
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Plot a graph of concentration of methyl ethanoate against time.

c) Using the graph in (b) determine the:

i) half life of the reaction.

ii) order of the reaction with respect to $\text{CH}_3\text{COOCH}_3$. Give a reason for your answer.

e) Calculate the rate constant and indicate its units.

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THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1																1.0 H 1	4.0 He 2
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															
			139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
			227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103