HWA CHONG INSTITUTION
C2 Preliminary Examinations
Higher 2

CANDIDATE NAME		**CT GROUP**	**16S**
CENTRE NUMBER		**INDEX NUMBER**	

CHEMISTRY

9729/01

Paper 1 Multiple Choice

20 September 2017

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

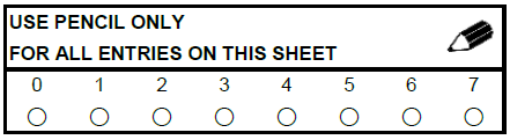
READ THESE INSTRUCTIONS FIRST

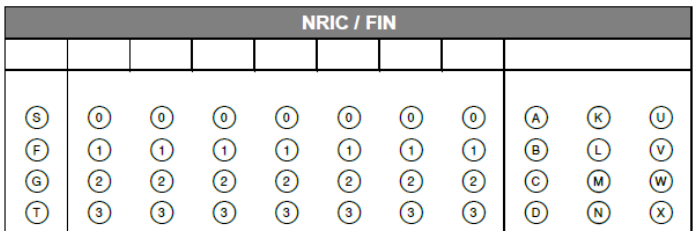
Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Complete the information on the Answer Sheet as shown below.

1. Enter your **NAME** (as in NRIC). _____
2. Enter the **PAPER NUMBER.** _____
3. Enter your **CT GROUP.** _____
4. Enter your **NRIC NUMBER** or **FIN Number**
5. Now **SHADE** the corresponding circles in the grid for **EACH DIGIT** or **LETTER**





There are **30** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

1 Why is the second ionisation energy of sodium higher than that of magnesium?

A Magnesium has more protons than sodium.

B Sodium has a complete octet, but magnesium does not.

C The ionic radius of Na^+ ion is larger than that of Mg^+ ion.

D The electron to be removed from sodium is closer to the nucleus.

2 *Use of the Data Booklet is relevant to this question.*

A mass of 0.457 g of solid carbon dioxide was vapourised into an evacuated gas syringe at r.t.p. A small amount of inert gas was introduced into the gas syringe and the volume of the gas syringe was 334.5 cm^3. The temperature was kept constant throughout.

How much inert gas was introduced into the gas syringe?

A 1.4×10^{-2} mol

B 3.3×10^{-3} mol

C 3.5×10^{-3} mol

D 4.3×10^{-3} mol

3 Propadiene and propyne both have the same molecular formula, C_3H_4. They exist in equilibrium as shown:

$$H_2C{=}C{=}CH_2 \rightleftharpoons CH_3C{\equiv}CH$$

propadiene propyne

Which bond is present in propadiene but **not** present in propyne?

A a σ bond formed by 1s – 2sp overlap

B a π bond formed by 2p – 2p overlap

C a σ bond formed by 2sp – $2sp^2$ overlap

D a σ bond formed by $2sp^2$ – $2sp^2$ overlap

4 Which molecules contain a 90º bond angle?

1	SF_6	2	PCl_5	3	XeF_4	4	$SiCl_4$

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 2 only

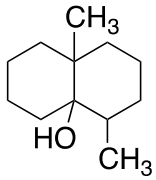
D 3 and 4 only

5 When $Tl^+(aq)$ ions are reacted with $VO_3^-(aq)$ ions, $Tl^{3+}(aq)$ ions and $V^{2+}(aq)$ ions are formed.

Assuming the reaction goes to completion, how many moles of $Tl^+(aq)$ and $VO_3^-(aq)$ would result in a mixture containing equal number of moles of $VO_3^-(aq)$ and $V^{2+}(aq)$ once the reaction had taken place?

	moles of $Tl^+(aq)$	moles of $VO_3^-(aq)$
A	1	2
B	1	3
C	3	2
D	3	4

6 Compound G is produced by actinobacteria in the soil and is responsible for the “it just rained” smell.



compound G

How many moles of oxygen gas are needed to completely burn 1 mole of compound G?

A 16.75 **B** 17.00 **C** 17.25 **D** 17.50

7 Which of the following changes will result in an increase in entropy?

A forward reaction of $[Fe(H_2O)_6]^{2+}(aq) + edta^{4-}(aq) \rightleftharpoons [Fe(edta)]^{2-}(aq) + 6H_2O(l)$

B mixing of 1 mol of N_2 with 1 mol of Ar at constant volume and temperature

C cooling of liquid ethanol from 50 °C to 20 °C

D condensation of water vapour

8 Which equation correctly represents both the enthalpy change of combustion, ΔH_c, and the enthalpy change of formation, ΔH_f, of the respective species?

	ΔH_c	ΔH_f	equation
1	Na(s)	$Na_2O(s)$	$2Na(s) + \frac{1}{2}O_2(g) \rightarrow Na_2O(s)$
2	C(s)	$CO_2(g)$	$C(s) + O_2(g) \rightarrow CO_2(g)$
3	$H_2(g)$	$H_2O(l)$	$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$

A 1 and 2 only

B 2 and 3 only

C 2 only

D 1, 2 and 3

9 The mechanism below has been proposed for the reaction between $CHCl_3$ and Cl_2.

Step 1: $Cl_2(g) \rightleftharpoons 2Cl(g)$ fast

Step 2: $Cl(g) + CHCl_3(g) \rightarrow CCl_3(g) + HCl(g)$ slow

Step 3: $CCl_3(g) + Cl(g) \rightarrow CCl_4(g)$ fast

Which rate equation is consistent with this mechanism?

A rate = $k[CHCl_3]^1 [Cl]^1$

B rate = $k[CHCl_3]^1 [Cl_2]^1$

C rate = $k[CHCl_3]^1 [Cl_2]^{\frac{1}{2}}$

D rate = $k[Cl_2]^1$

10 Iodine–131 is a radioactive isotope with a half-life of 8 days. Given that radioactive decay is a first-order reaction, what fraction of the isotope would remain after 80 days?

A $\frac{1}{20}$ **B** $\frac{1}{160}$ **C** $\frac{1}{2^8}$ **D** $\frac{1}{2^{10}}$

11 The enthalpy change of reaction for the conversion of sulfur dioxide to sulfur trioxide is shown below.

$$2SO_2\,(g) + O_2\,(g) \rightleftharpoons 2SO_3\,(g) \qquad \Delta H = -196\ kJ\ mol^{-1}$$

Which of the following statements is correct?

A When the volume of the system increases at constant temperature, the yield of SO_3 increases.

B When a catalyst is introduced to the system, the yield of SO_3 increases.

C The forward reaction is spontaneous at all temperatures.

D When the temperature is increased, K_c decreases.

12 Which of the following silver compounds would give the highest concentration of silver ions in its saturated solution?

	compound	magnitude of solubility product
A	AgCN	6×10^{-17}
B	AgSCN	1×10^{-12}
C	Ag_2SO_3	2×10^{-14}
D	Ag_3PO_4	9×10^{-17}

13 Which of the following is a satisfactory indicator for the titration of 0.1 mol dm^{-3} methylamine and 0.1 mol dm^{-3} hydrochloric acid?

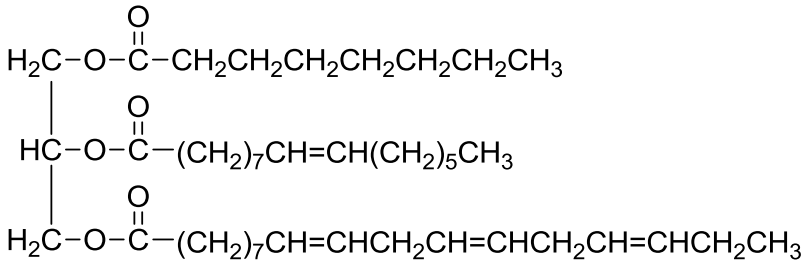
A methyl red (pH range 4.2 – 6.3)

B bromothymol blue (pH range 6.0 – 7.6)

C phenolphthalein (pH range 8.2 – 10.0)

D There is no satisfactory indicator.

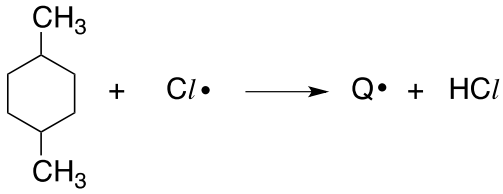
14 Triglycerides are the main constituents of body fat in humans and animals. The diagram shows the structure of a triglyceride.



What is the total number of stereoisomers possible for this triglyceride?

A 2^1 **B** 2^3 **C** 2^4 **D** 2^5

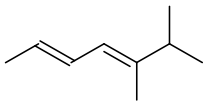
15 When heated with chlorine, the following hydrocarbon undergoes free radical substitution. In the propagation step, the free radical Q• is formed by the loss of one hydrogen atom.



Ignoring any stereoisomers, how many different forms of Q• are theoretically possible?

A 3 **B** 4 **C** 6 **D** 8

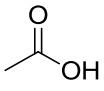
16 Compound W is heated with excess acidified $KMnO_4$ for a prolonged period.

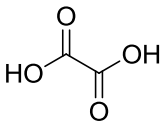


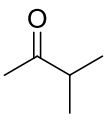
compound W

Which of the following compounds is **least likely** to be a product of this reaction?

A CO_2

B 

C 

D 

17 Liquid bromine is added separately to the following pairs of compounds under various conditions.

Which of the following pairs of compounds will give the same observations?

A Benzene and phenol, in the presence of *uv* light.

B Hexane and methylbenzene, in the presence of *uv* light.

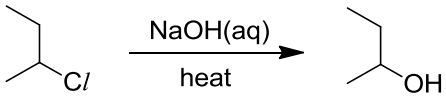
C Pentene and pentane, in the absence of *uv* light.

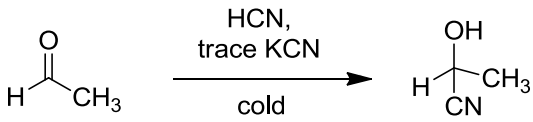
D Phenylamine and benzene, in the absence of *uv* light.

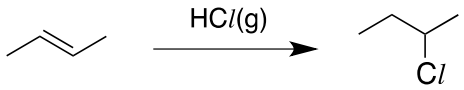
18 Enantiomeric excess is the measure of the excess of one enantiomer over another in a mixture.

Consider a pair of enantiomers, R and S. If the R enantiomer makes up 75% of the mixture while the S enantiomer makes up 25% of the mixture, R has an enantiomeric excess of 50%.

Which of the following reactions would result in a mixture which gives an enantiomeric excess of 0%?

1 

2 

3 

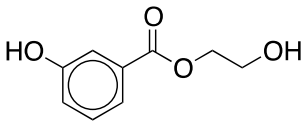
A 1 and 2 only

B 1 and 3 only

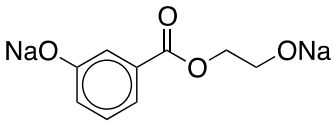
C 2 and 3 only

D 1, 2 and 3

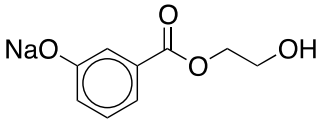
19 What will be produced when the following compound is reacted with cold NaOH(aq)?



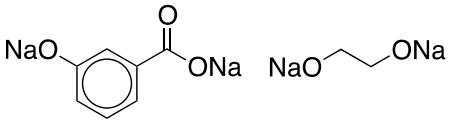
A



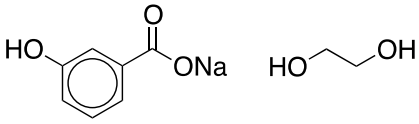
B



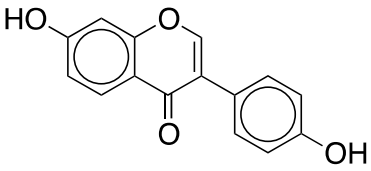
C



D



20 Diadzein belongs to a class of compounds known as isoflavenoids, and is a major component of soya beans.



diadzein

Which statement about diadzein is **not** correct?

A When diadzein reacts with aqueous Br_2, the product contains chiral centres.

B When heated with ethanoic acid and concentrated sulfuric acid, diadzein forms an ester.

C When neutral $FeCl_3$ is added to diadzein, a purple colouration is observed.

D When 2,4-DNPH is added to diadzein, an orange precipitate is observed.

21 Which reaction yields a carbon compound incorporating deuterium, D? [D = ^{2}H]

A $CH_3CH_2CN \xrightarrow[\text{heat}]{\text{NaOD, } D_2O}$

B $CH_3CD(OD)CO_2H \xrightarrow[\text{heat}]{\text{acidified } KMnO_4}$

C $CH_3COCI_3 \xrightarrow[\text{heat}]{\text{NaOD, } D_2O}$

D $(CH_3)_3COH \xrightarrow[\text{heat}]{\text{conc. } D_2SO_4}$

22 Which of the following statements about the reaction with Fehling's reagent is correct?

1 In a positive test, Cu^{2+} is reduced to produce an oxide.

2 Propanone will react to form a propanoate ion.

3 Benzaldehyde will give a brick-red precipitate.

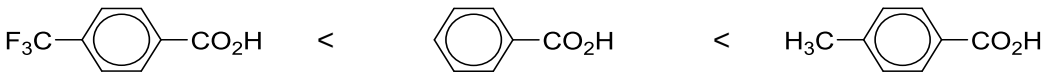
A 1 only

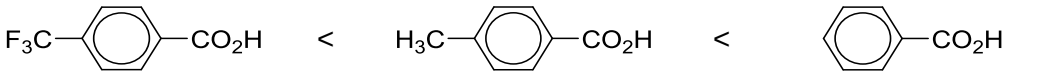
B 1 and 2 only

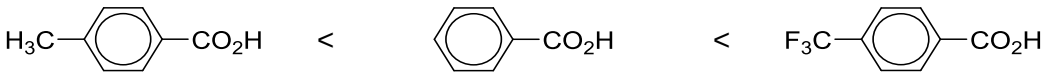
C 1 and 3 only

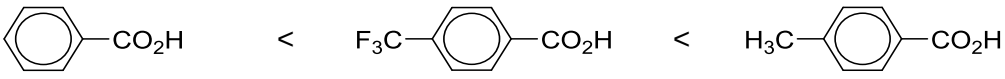
D 2 and 3 only

23 Which of the following shows an increasing trend in pK_a ?

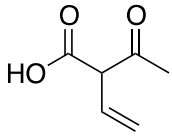
A 

B 

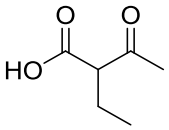
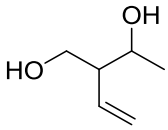
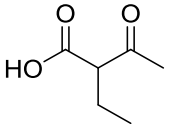
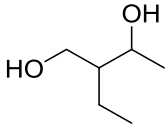
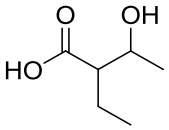
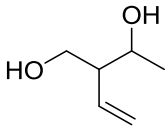
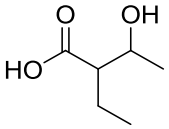
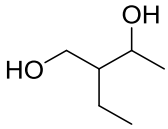
C 

D 

24 Which are the products formed when compound Z reacts with the following reducing agents?

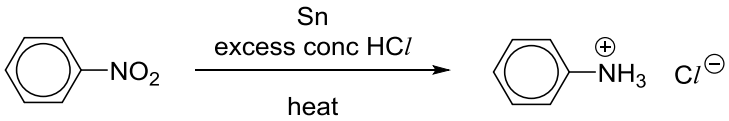


compound Z

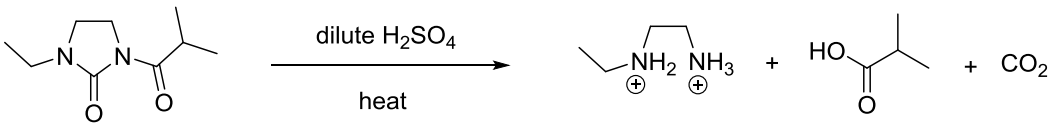
	H_2, Pt	$LiAlH_4$ in dry ether
A		
B		
C		
D		

25 Which of the following transformations is **not** correct?

A



B



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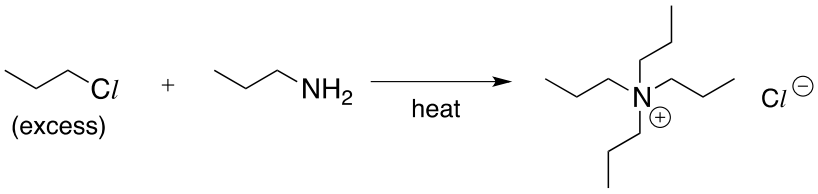
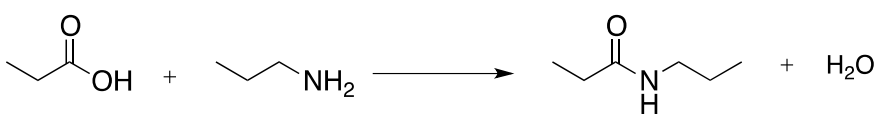


D



26 *Use of the Data Booklet is relevant to this question*.

By considering the relevant $E^{\ominus}$ values, which halogen will oxidise $Fe^{2+}(aq)$ to $Fe^{3+}(aq)$?

A bromine and chlorine only

B bromine and iodine only

C chlorine only

D iodine only

27 Which of the following about the anodising of aluminium using dilute sulfuric acid is correct?

1 The thickness of the solid Al_2O_3 layer on the surface of the aluminium object is increased.

2 Oxygen is produced at the cathode.

3 The *Al* object to be anodised is the positive electrode.

A 1 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

28 Y is an element in Period 3. When water is added to a chloride of Y, an acidic solution will be obtained. When water is added to an oxide of Y, a basic solution will be obtained.

Which of the following could Y be?

A Na **B** Mg **C** *Al* **D** Si

29 Which of the following correctly describes the complex formed when different reagents are added to solid copper(II) sulfate?

	reagent added	colour of resultant solution	shape of complex ion formed
1	H_2O	pale blue	octahedral
2	conc. HC*l*	yellow	tetrahedral
3	excess NH_3(aq)	dark blue	tetrahedral

A 1 and 2 only

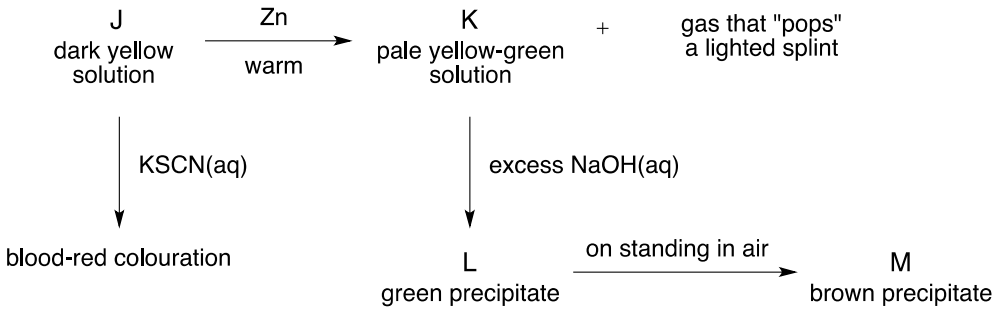
B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

30 *Use of the Data Booklet is relevant to this question*.

Consider the following reaction scheme starting from solution J, which contains one metal cation.



Which of the following statements is correct?

A The metal cation present in solution J is Fe^{2+}.

B The gas produced is able to reduce Fe^{2+} to Fe.

C The reaction from K to L is a ligand exchange reaction.

D The metal cation present in solution J and in precipitate M is the same.