JURONG JUNIOR COLLEGE

JC 2 PRELIMINARY EXAMINATION

Higher 1

CHEMISTRY 8872/01

Paper 1 Multiple Choice **13 September 2012**

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and shade your exam index number on the Answer Sheet in the spaces provided.

There are **thirty** 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 separate 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.

A *Data Booklet* is provided. Do not write anything on the *Data Booklet*.

SECTION A

For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

1. 0.200 mol of a hydrocarbon undergo complete combustion to give 35.2 g of carbon dioxide and 14.4 g of water as the only products.

What is the molecular formula of the hydrocarbon?

A C_2H_4 **B** C_2H_6

C C_4H_4 **D** C_4H_8

2. A giant molecule contains a mixture of two carbon isotopes, ^{12}C and ^{13}C. It was found that the relative atomic mass of carbon in the molecule is 12.20.

What is the ratio of ^{12}C to ^{13}C in the molecule?

A 5:4 **B** 4:1 **C** 4:5 **D** 1:4

3. The use of *Data Booklet* is relevant to this question.

In research on the atomic nucleus, scientists have been comparing the stability of isotopes with the same neutron : proton ratio.

Which isotope has the same neutron : proton ratio as ^{10}B?

A ^{32}P

B ^{40}Ar

C ^{32}S

D ^{40}K

4. Which element has an equal number of electron pairs and of unpaired electrons in the orbitals of principal quantum number 2?

A beryllium

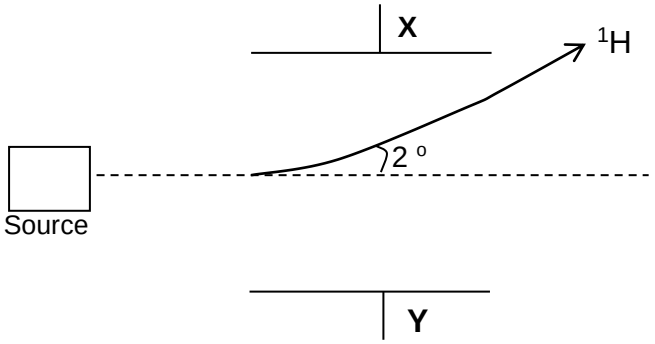
B carbon

C nitrogen

D oxygen

5. A plasma is a gaseous mixture in which the atoms have been completely stripped of their electrons, leaving bare nuclei. Due to possible use in controlled nuclear fusion reactions, plasma behavior has been intensively studied.

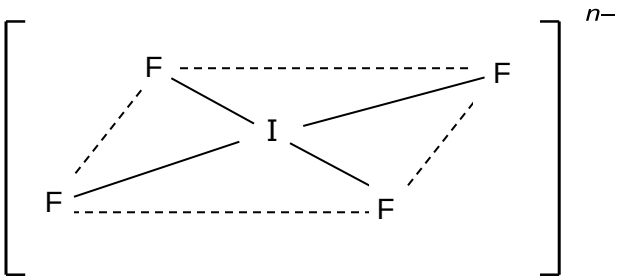
When passed between two electrically charged plates, ^{1}H and ^{4}He nuclei are deflected differently. The deflection path of ^{1}H is shown in the diagram below.



Which of the following is correct?

	Polarity of Plate		direction of deflection of ^{4}He	angle of deflection of ^{4}He
	X	**Y**		
A	–	+	towards **Y**	0.5 °
B	+	–	towards **Y**	1 °
C	–	+	towards **X**	1 °
D	+	–	towards **X**	0.5 °

6. An ion IF_4^{n-} has a square planar shape as shown below.



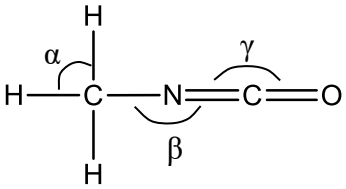
What is the value of *n*?

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

7. Methyl isocyanate, CH_3NCO, is a toxic liquid which is used in the manufacture of some pesticides.

The sequence of atoms in the methyl isocyanate molecule is $H_3C{-}N{=}C{=}O$.

What is the correct **increasing** order of bond angles α, β and γ in the molecule shown below?



A $\gamma < \beta < \alpha$ **B** $\beta < \alpha < \gamma$ **C** $\alpha < \beta < \gamma$ **D** $\alpha < \gamma < \beta$

8. Three elements, **E**, **F** and **G**, have the physical properties shown in the table.

element	melting point / °C	boiling point / °C	density / g cm^{-3}
E	–7	59	3.12
F	98	883	0.97
G	649	1107	1.74

What could be the identities of **E**, **F** and **G**?

	E	**F**	**G**
A	Br_2	A*l*	Si
B	Br_2	Na	Mg
C	I_2	Mg	Na
D	I_2	Si	K

9. Which of the following correctly describes the effect of pressure change on the following equilibrium?

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

	Pressure	**Proportion of N_2 and H_2**	**Effect on equilibrium constant**
A	increases	increases	no change
B	increases	decreases	no change
C	decreases	increases	decreases
D	decreases	decreases	increases

10. The standard enthalpy change for two reactions are given by the equations:

$$2Fe(s) + \frac{3}{2}O_2(g) \rightarrow Fe_2O_3(s) \qquad \Delta H^\ominus = -822 \text{ kJ mol}^{-1}$$

$$C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g) \qquad \Delta H^\ominus = -110 \text{ kJ mol}^{-1}$$

What is the standard enthalpy change for the following reaction?

$$Fe_2O_3(s) + 3C(s) \rightarrow 2Fe(s) + 3CO(g)$$

A -712 kJ mol^{-1}

B -492 kJ mol^{-1}

C $+712$ kJ mol^{-1}

D $+492$ kJ mol^{-1}

11. Which of the following is **not** a conjugate acid-base pair?

A $NH_3^+CH_2CO_2^-$ and $NH_2CH_2CO_2^-$

B OH^- and O^{2-}

C HPO_4^{2-} and $H_2PO_4^-$

D H_2SO_4 and SO_4^{2-}

12. Which sequence shows the compounds in order of **decreasing** pK_a values?

A $CH_3CO_2H > C_2H_5OH > CF_3CO_2H > CCl_3CO_2H$

B $CF_3CO_2H > CCl_3CO_2H > CH_3CO_2H > C_2H_5OH$

C $C_2H_5OH > CH_3CO_2H > CCl_3CO_2H > CF_3CO_2H$

D $CCl_3CO_2H > CF_3CO_2H > C_2H_5OH > CH_3CO_2H$

13. The rate of removal of the pain-killing drug paracetamol from the body is a first order reaction with a rate constant, k, of 0.26 h^{-1}.

How long will it take for 50% of the paracetamol ingested to remain in the body?

A 0.26 h

B 0.52 h

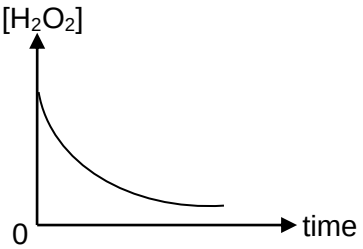
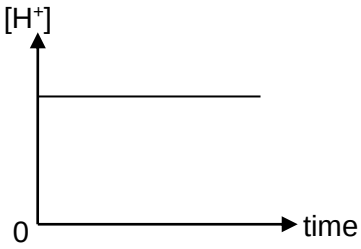
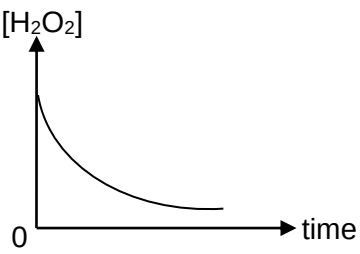
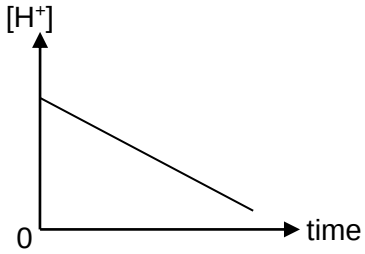
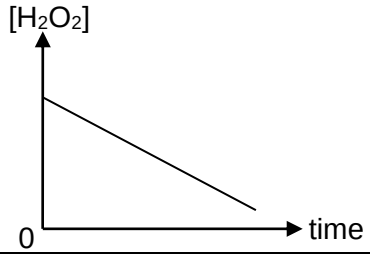
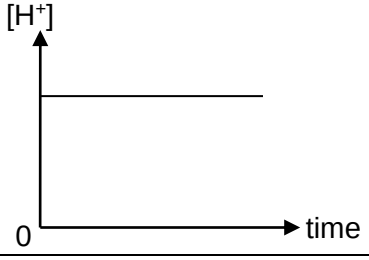
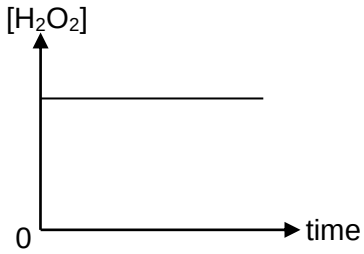
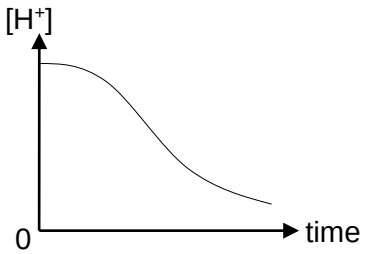
C 2.7 h

D 5.4 h

14. The reaction of hydrogen peroxide with iodide ions in an acidic solution is first order with respect to hydrogen peroxide as well as iodide ions, and zero order with respect to hydrogen ions.

$$H_2O_2(aq) + 2H^+(aq) + 2I^-(aq) \rightarrow 2H_2O(l) + I_2(aq)$$

Two experiments were carried out seperately. Which pair of diagrams represents the variation of $[H_2O_2]$ and $[H^+]$ with time?

	Experiment 1: In the presence of excess I^-	**Experiment 2: In the presence of excess I^- and H_2O_2**
A		
B		
C		
D		

15. Some compounds of Period 3 elements dissolve in water to form aqueous solutions that are acidic, basic or neutral.

Which one of the following sequences shows the order of **decreasing** pH of the resultant solutions formed when the following compounds are dissolved in water?

A MgO, A*l*C*l*$_3$, P_4O_{10}

B SiC*l*$_4$, MgC*l*$_2$, NaC*l*

C PC*l*$_5$, SiC*l*$_4$, A*l*C*l*$_3$

D A*l*$_2$O$_3$, MgO, SO_2

16. Methyl mercaptan, CH_3SH, has a foul smell and is often used to impart a smell to natural gas. What will be formed when CH_3SH is burned in an excess of air?

A CO H_2O SO_2

B CO_2 H_2O H_2S

C CO_2 H_2O SO_2

D CO_2 H_2O SO_3

17. A Period 3 element **H** is a good conductor of electricity in the solid and liquid states. It reacts violently with oxygen and water.

Which of the following statements is correct about element **H**?

A Element **H** has a giant metallic structure.

B The mobile charged carriers of **H** in the solid state are ions and electrons.

C When the oxide of **H** is added to water, the resulting solution turns Universal Indicator red.

D The value of the first ionisation energy of element **H** is bigger than the value of first ionisation energy of argon.

18. How many of the isomeric alcohols with the formula C_4H_9OH will produce an alkene that has cis and trans isomers, on treatment with concentrated sulfuric acid?

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

19. In which class of compound, in its general formula, is the ratio of hydrogen atoms to carbon atoms the highest?

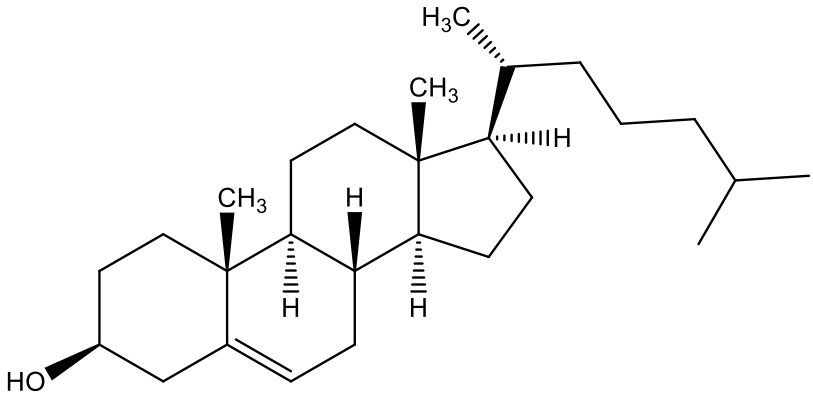
A alcohols

B aldehydes

C carboxylic acids

D halogenoalkanes

20. The diagram shows the structure of the naturally-occurring molecule cholesterol.



Separate oxidation reactions are carried out on cholesterol using different conditions.

- cold, dilute acidified $KMnO_4$
- hot, concentrated acidified $KMnO_4$

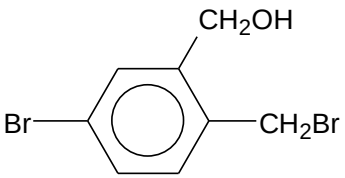
Which statements about the **products** formed are correct?

	cold, dilute acidified $KMnO_4$: number of hydroxy groups present	hot, concentrated acidified $KMnO_4$: number of 6-membered rings remaining
A	1	2
B	1	3
C	3	3
D	3	2

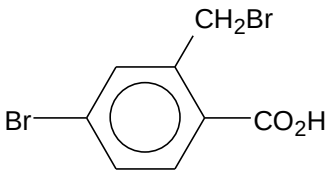
21. 1 mole of an organic compound **J** reacts with 2 moles of NaOH(aq) when heated. 1 mole of **J** also reacts with PCl_5 to produce 1 mole of HCl(g).

Which of the following compounds could be **J**?

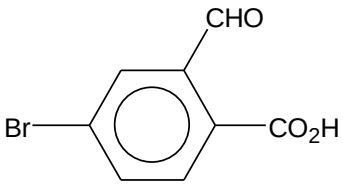
A



B



C



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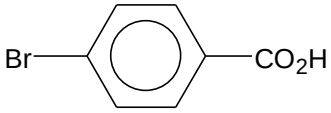


22. Which of these compounds turn orange acidified sodium dichromate(VI) solution green and also gives a silver mirror with Tollens' reagent?

$CH_3COCH_2CH_2OH$	CH_3COCH_2CHO	$CH_3CH(OH)CH_2CH_3$	$CH_3CH_2CH_2CHO$
K	***L***	***M***	***N***

A ***K*** and ***L*** only

B ***K*** and ***N*** only

C ***M*** and ***N*** only

D ***L*** and ***N*** only

23. 2–methylpropanoic acid, $(CH_3)_2CHCOOH$, may be synthesised from 1–bromopropane, $BrCH_2CH_2CH_3$, through a series of reactions.

Which set of reagents, used in sequential order, would be the most suitable for this synthesis?

A aqueous KOH, acidified $KMnO_4$

B aqueous KOH, PCl_5, ethanolic KCN, dilute H_2SO_4

C ethanolic KOH, HBr, ethanolic KCN, dilute H_2SO_4

D ethanolic KOH, HBr, HCN with NaOH catalyst, dilute H_2SO_4

24. Compound **P** is heated in a sealed tube with excess ammonia while compound **Q** is reacted with $LiAlH_4$ in dry ether.

Which of the following pairs of **P** and **Q** give the same product?

	P	**Q**
A	$BrCH_2CH_2CH_2OH$	$HOOCCH_2CN$
B	$CH_3CH_2CH_2OH$	CH_3CH_2CN
C	$(CH_3)_2CHCl$	$(CH_3)_2CHCN$
D	$C_6H_5CHBrCH_2CH_3$	$C_6H_5CH(CN)CH_2CH_3$

25. Which compound

- is unaffected by hot alkaline potassium manganate(VII);
- gives hydrogen gas when treated with sodium?

A $(CH_3)_2CHCOCH_3$

B $(CH_3)_3COH$

C $CH_3CH_2CH(OH)CH_3$

D $CH_3CO_2CH_2CH_2OH$

SECTION B

For each of the questions in this section, one or more of the three numbered statements **1** to **3** may be correct.

Decide whether each of the statements is or is not correct.

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

26. Deposits of ammonium compounds have been discovered in areas of high atmospheric pollution. They are believed to arise from the following reaction.

$$SO_3 + H_2O + 2NH_3 \rightarrow (NH_4)_2SO_4$$

Which statements about this reaction are true?

1 SO_3 is a reducing agent.

2 Aqueous $(NH_4)_2SO_4$ is a good electrical conductor.

3 The product contains a co-ordinate bond.

27. The concepts of bond energy, bond length and bond polarity are useful when comparing the behaviour of similar molecules, e.g. thermal stability.

For example, it could be said

"Compared with the HCl molecule, the bond **R** *of the HI molecule is* **S** *."*

Which pairs of words correctly complete the above sentence?

	R	S
1	energy	greater
2	length	greater
3	polarity	less

28. In a car engine, non-metallic element **T** forms a pollutant oxide **U**.

Further oxidation of **U** to **V** occurs spontaneously in the atmosphere. In this further oxidation, 1 mol of **U** reacts with 0.5 mol of gaseous oxygen.

Which statements about **T**, **U** and **V** are correct?

1 **V** is a polar molecule.

2 **T** is a diatomic molecule.

3 The compound formed between **T** and hydrogen is basic.

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

29. Two unlabelled beakers containing equal volumes of 0.5 mol dm^{-3} hydrochloric acid and 0.5 mol dm^{-3} ethanoic acid were given.

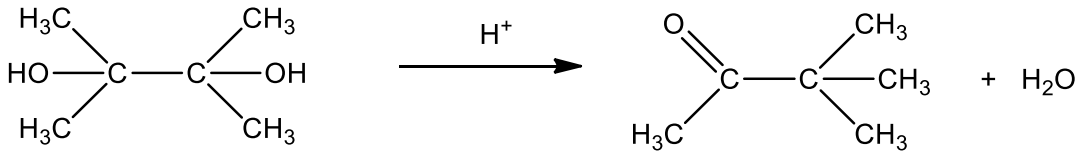
Which statements are correct?

1 The K_a of ethanoic acid increases with temperature.

2 The temperature change recorded is higher for the case of hydrochloric acid when both solutions are separately added to excess NaOH(aq).

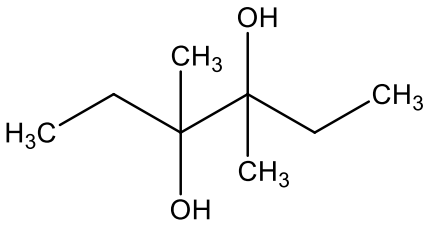
3 The volume of H_2 collected when both solutions are separately reacted with excess Mg metal is the same.

30. The pinacol rearrangement involves the reaction of a diol in acidic conditions to form a carbonyl compound as shown below.



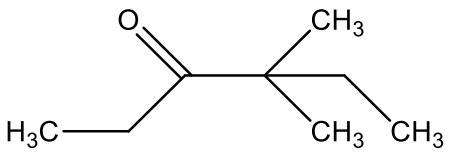
2,3-dimethylbutan-2,3-diol 3,3-dimethylbutan-2-one

Which one of the following structural formula is a product of the pinacol rearrangement of 3,4-dimethylhexa-3,4-diol with the structure as shown below?



3,4-dimethylhexa-3,4-diol

1



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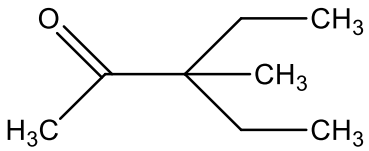

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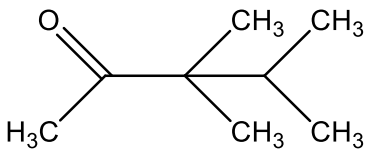

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