Class	Adm No

Candidate Name: _____

Promotional Examination II 2009
Pre-university 2

H1 CHEMISTRY 8872
PAPER 1 8872 / 1

Tuesday 15 September 2009 50 m

Additional materials:
OMR
Data Booklet

INSTRUCTIONS TO CANDIDATES

1. Do not turn over this question paper until you are told to do so.
2. Write your name, class and index number in the spaces provided at the top of this page and on the OMR provided.
3. Answer **ALL** questions and shade the correct answers on the OMR provided.
4. Hand in the question paper and the OMR separately.

FOR EXAMINER'S USE	
Section	Total
Marks	30

INFORMATION FOR CANDIDATES

Marks will not be deducted for wrong answers; your total score on this test will be the number of correct answers given.

SECTION A (25 marks)

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

1. Which statement is **FALSE**?

A One mole of ^{12}C has a mass of 12.00g.
B One mole of methane contains 75% of carbon by mass.
C One mole of methane contains four moles of hydrogen atoms.
D One mole of hydrogen gas contains 6.02×10^{23} atoms of hydrogen.

2. A 1.881 g sample of an unknown metallic carbonate is decomposed by heating to form the metallic oxide and 0.66 g of carbon dioxide according to the equation:

$$\mathbf{M}CO_3(s) \rightarrow \mathbf{M}O(s) + CO_2(g)$$

What is metal, **M**?

A Ca
B Mn
C Ni
D Zn

3. In an experiment, 50 cm^3 of a 0.1 mol dm^{-3} solution of a metallic salt reacted exactly with 25 cm^3 of 0.1 mol dm^{-3} sodium sulphite solution. The half equation for oxidation of sulphite ion is

$$SO_3^{2-}(aq) + H_2O(l) \rightarrow SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$$

If the original oxidation number of the metal in the salt was +3, what would be the new oxidation number of the metal?

A 0
B +1
C +2
D +4

4. When 20 cm^3 of a gaseous hydrocarbon was completely burnt in an excess of oxygen, 60 cm^3 of carbon dioxide and 60 cm^3 of water vapour were formed, all volumes being measured at the same temperature and pressure. What is the molecular formula of the hydrocarbon?

A CH_2
B C_2H_6
C C_3H_6
D C_3H_8

5. Why is the first ionisation energy of sulphur lower than that of phosphorus?

A Sulphur forms an anion more readily.
B Sulphur is more electronegative than phosphorus.
C The sulphur atom is larger than the phosphorus atom.
D The electron to be lost is paired with another electron.

6. Which of the following ions will be deflected the least when passed through an electric field?

A $^{24}_{12}Mg^{2+}$
B $^{27}_{13}Al^{3+}$
C $^{16}_{8}O^{2-}$
D $^{31}_{15}P^{3-}$

7. **X** and **Y** are elements with the following successive ionisation energies in kJ mol^{-1}.

X	580	1800	2700	11600	14800	18400	23300
Y	1310	3400	5300	7500	11300	13300	35000

What is the compound that is formed from element X and Y?

A XY_4
B X_2Y_3
C X_3Y_2
D X_4Y

8. Which of the following molecules **do not** have all the atoms lying on the same plane?

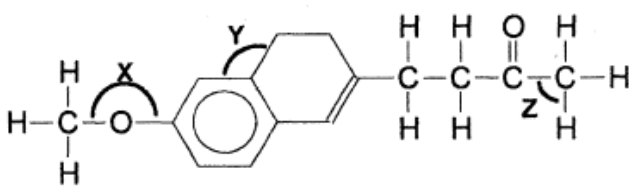
A PH_3

B H_2O

C ICl_3

D $BrCl_4^-$

9. Which one of the following shows increasing magnitudes of angles X, Y and Z?



A Y < Z < X

B Z < X < Y

C X < Z < Y

D Z< Y < X

10. Three substances, **X**, **Y** and **Z** have physical properties as shown.

Substance	Melting point /°C	Boiling point /°C	Electrical Conductivity	
			of solid	of molten
X	801	1413	poor	good
Y	2852	3600	poor	good
Z	3550	4827	good	not known

What could be the identities of **X**, **Y** and **Z**?

	X	**Y**	**Z**
A	NaF	$BeCl_2$	Cu
B	NaCl	MgO	graphite
C	NaBr	CaO	SiO_2
D	NaI	Al_2O_3	diamond

11. The table below give the enthalpy change of combustion of ethyne (C_2H_2), hydrogen (H_2) and ethane (C_2H_6).

Compound	**ΔH_c / kJ mol^{-1}**
Ethyne	-1300
Hydrogen	-285
Ethane	-1560

What is the enthalpy change for the following reaction?

$$C_2H_2(g) + 2H_2(g) \rightarrow C_2H_6(g)$$

A +130 kJ

B +155 kJ

C -155 kJ

D -310 kJ

12. For which of the following reactions does the value of ΔH^{θ}_{rxn} represent both a standard enthalpy change of combustion and a standard enthalpy change of formation of a substance?

A $2S\,(s) + O_2\,(g) \rightarrow 2SO_2\,(g)$

B $S\,(g) + O_2\,(g) \rightarrow SO_2\,(g)$

C $S\,(s) + O_2\,(g) \rightarrow SO_2\,(g)$

D $SO\,(g) + O_2\,(g) \rightarrow SO_2\,(g)$

13. If the reaction

P + Q → R + S

is described as being zero order with respect to **P**, which of the following statements best describes **P**?

A **P** is a catalyst in the above reaction.

B The concentration of **P** does not change during the reaction.

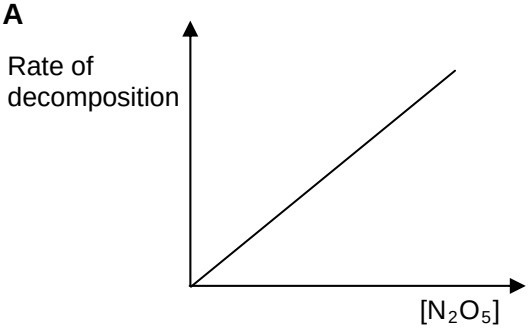
C There are no **P** molecules which possess sufficient energy to react.

D The rate of reaction is independent of the concentration of **P**.

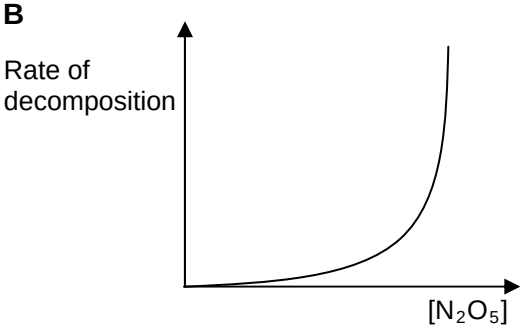
14. The decomposition of dinitrogen pentoxide, N_2O_5, was found to be first order with respect to N_2O_5.

Which one of the following graphs confirms the result?

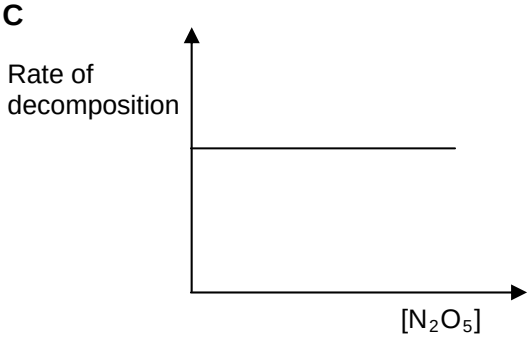
A



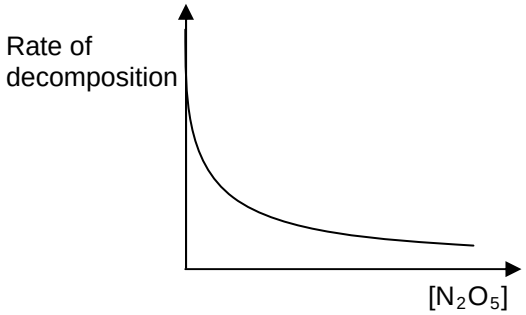
B



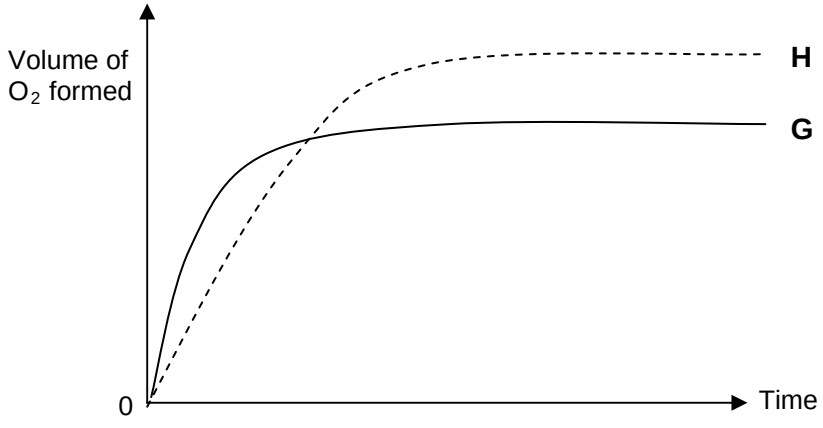
C



D



15. In the diagram, curve **G** was obtained by observing the decomposition of 100 cm^3 of 1.0 mol dm^{-3} of hydrogen peroxide, catalysed by manganese (IV) oxide.



Which alteration to the original experimental conditions would produce curve **H**?

A Adding water

B Increasing the temperature

C Using less manganese (IV) oxide

D Adding some 0.1 mol dm^{-3} hydrogen peroxide

16. Compound X decomposes upon heating according to the following equation:

$$2X\ (s) \rightleftharpoons Y\ (g) + 2Z\ (g)$$

When 5 mol of **X** were put into a 1 dm^3 container and heated, the equilibrium mixture contained 0.6 mol of **Y**.

What is the approximate numerical value of the equilibrium constant K_c?

A 0.060

B 0.094

C 0.189

D 0.864

17. Two experiments were performed involving the following equilibrium.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g); \qquad \Delta H = +54\ kJ\ mol^{-1}$$

In experiment (1) carried out at temperature T_1 K, the equilibrium constant, $K_c = 64$.

In a separate experiment (2), 1.0 mol of H_2 and 1.0 mol of I_2 were initially added into a 1 dm^3 flask. The flask was found to contain 1.2 mol of HI at equilibrium.

What can you infer from the data?

A 1.2 mol of HI was present at equilibrium in experiment (1).

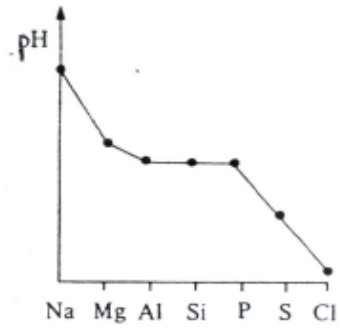
B Total pressure was reduced in experiment (1).

C Temperature in experiment (1) is different from that in experiment (2).

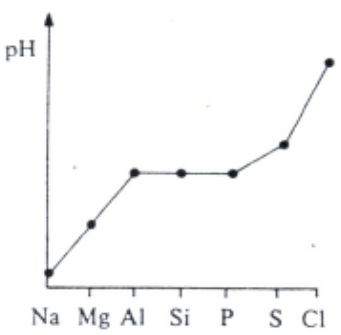
D The relationship between T_1 and T_2 cannot be determined.

18. In separate experiments, 1 mol each of the chlorides of the elements sodium to chlorine is added to water. Which of the following diagrams best represents how the pH of the solutions produced varies with the atomic number of the elements?

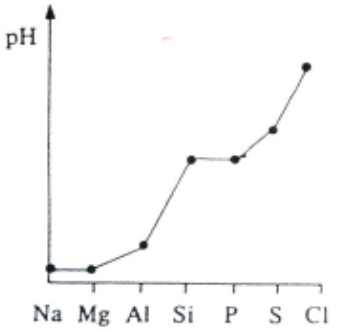
A



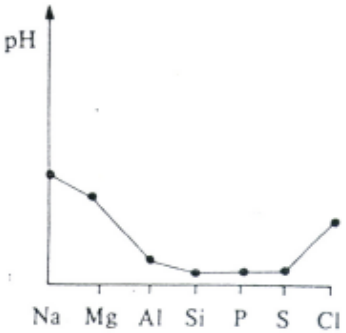
B



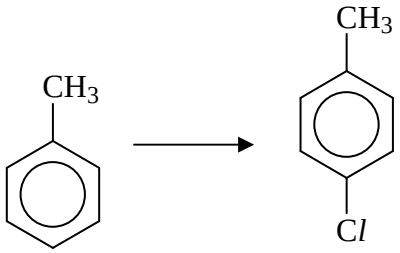
C



D



19. Which is the following process known as?



A nucleophilic addition

B nucleophilic substitution

C electrophilic substitution

D electrophilic addition

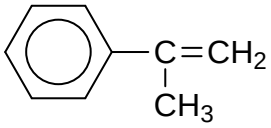
20. Which reagent gives the same visible result with propanal and with propan-2-ol?

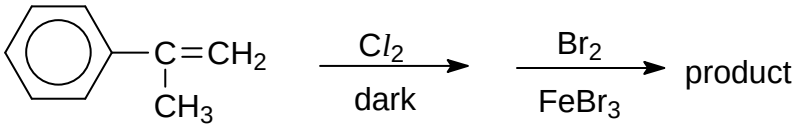
A Fehling's reagent

B concentrated sulphuric acid

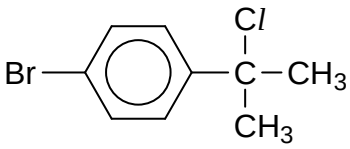
C acidified potassium manganate(VII)

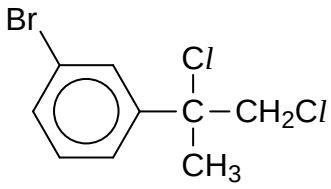
D 2,4-dinitrophenylhydrazine

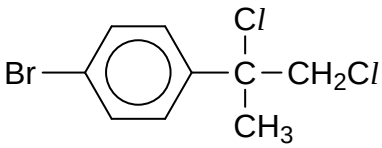
21.  undergoes a series of reactions as shown.

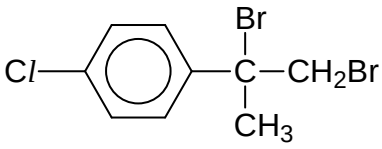


What is the structural formula of the product formed?

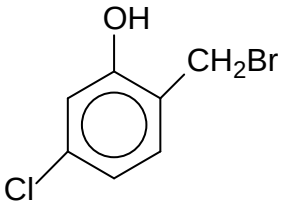
A 

B 

C 

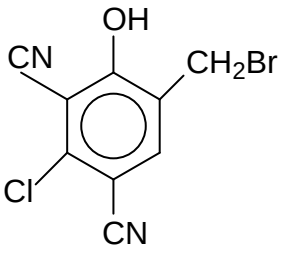
D 

22. Compound **W** has the following structure:

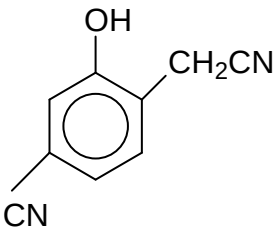


Which compound is obtained when compound **W** is heated with aqueous alcoholic KCN?

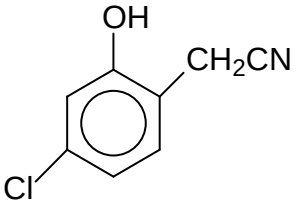
A



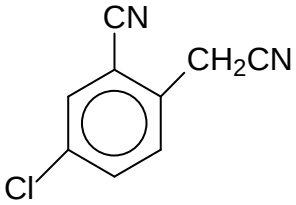
C



B



D

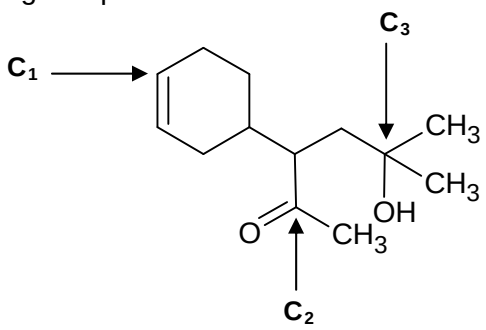


23. **X**, **Y** and **Z** are three organic compounds. **X** undergoes oxidation with hot acidified potassium manganate(VII) to give **Y** and **Z**. **Y** gives a orange precipitate with 2,4-dinitrophenylhydrazine but gives negative results with Tollen's reagent. **Z** reacts with sodium carbonate to give strong effervescence of carbon dioxide.

Which of the following organic compounds could be **X**, **Y** and **Z**?

	X	**Y**	**Z**
A	$CH_3CH(OH)CH=CHCH_3$	$CH_3CH(OH)CHO$	CH_3CO_2H
B	$CH_3CH(OH)C(CH_3)=CHCH_3$	CH_3CH_2COCHO	CH_3CO_2H
C	$CH_3CH(OH)C(CH_3)=CHCH_3$	$CH_3COCOCH_3$	CH_3CO_2H
D	$CH_3COC(CH_3)=C(CH_3)_2$	$CH_3COCOCH_3$	CH_3COH_3

24. Given the following compound **Z**:



Which of the following options correctly states the type of hybridisation of $\mathbf{C_1}$, $\mathbf{C_2}$ and $\mathbf{C_3}$?

	$\mathbf{C_1}$	$\mathbf{C_2}$	$\mathbf{C_3}$
A	sp	sp	sp^2
B	sp^2	sp^3	sp^3
C	sp^3	sp^2	sp^2
D	sp^2	sp^2	sp^3

25. Organic compound **Q** undergone the following successive reactions:

I reaction with hydrogen chloride

II boiling with aqueous sodium hydroxide

III reaction with hot concentrated sulphuric acid

The final organic product was ethene.

Which of the following could most likely be compound **Q**?

A Ethene

B Ethanol

C Chloroethane

D Ethanoic acid

SECTION B (5 marks)

For questions 26 – 30 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 (you may find it helpful to put a tick against the statements which you consider to be 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

26. The conversion of CrO_4^{2-} (aq) into $Cr_2O_7^{2-}$ (aq) is represented by the following equation:

$$CrO_4^{2-}\ (aq) + 2H^+\ (aq) \rightleftharpoons Cr_2O_7^{2-}\ (aq) + H_2O\ (l)$$

Which statement(s) is/are **TRUE** of this reaction?

1 CrO_4^{2-} (aq) acts as a base.

2 Addition of OH^- (aq) to the above system shifts the equilibrium to the left.

3 The conversion of CrO_4^{2-} (aq) into $Cr_2O_7^{2-}$ (aq) involves a change in oxidation state.

27. Which of the following statements describing the characteristics of elements within any one particular group of the Periodic Table are correct?

1 The first ionisation energies of the elements decrease down the group.

2 The reactivity of the elements increases down the group.

3 The melting points of the elements generally decrease down the group.

28. An attractant produced by butterflies and moths has the following structural formula:

$$CH_3CO_2(CH_2)_6CH{=}CH(CH_2)_3CH_3$$

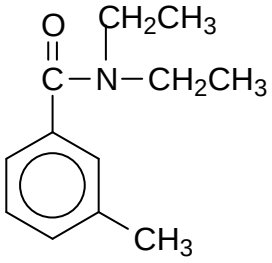
Based on the above structure, which of the following is/are true of the attractant?

1 It could exist as cis-trans isomer.

2 It can be hydrolysed by dilute hydrochloric acid.

3 It undergoes electrophilic addition with bromine.

29. *N,N*-diethyl-3-methylbenzamide, commonly known as **DEET**, is used in insect repellant which can be applied on human skin and clothing. The structure of **DEET** is shown below:



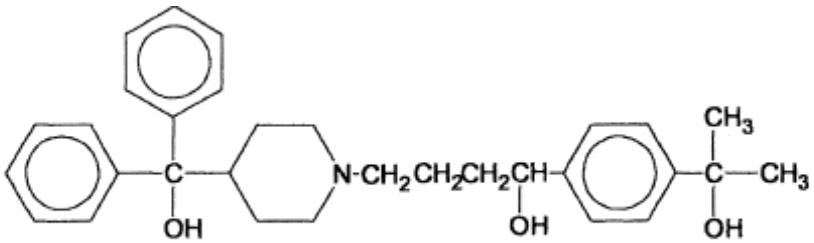
Which of the following reagents will react with **DEET**?

1 PCl_5

2 hot acidified $KMnO_4$

3 bromine with $FeBr_3$

30. Terfenadine is a drug that alleviates seasickness and asthma and it does not cause drowsiness as a side effect.



Terfenadine

What deduction(s) can be made from this structure?

1 Terfenadine reacts with concentrated sulphuric acid at 180°C to form a product that decolorises Br_2 (aq) at room condition.

2 It can be oxidized to form products that do not react with hot Tollen's reagent.

3 It is soluble in aqueous sodium hydroxide.

- END OF PAPER-