Yap NL

TAYLOR'S COLLEGE

Wisdom • Integrity • Excellence
since 1969

CAMBRIDGE A LEVEL PROGRAMME
AS TRIAL EXAMINATION MARCH/APRIL 2011
(June 2010 Intake)

Monday **28 March 2011** **8.30 am – 9.30 am**

CHEMISTRY 9701/12

PAPER 1 Multiple Choice 1 hour

Additional materials: Data Booklet
Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name and class on the answer sheet in the spaces provided

There are forty 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.

This document consists of **12** printed pages.

[Turn over

Section A

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

1 *The use of the Data Booklet is relevant to this question.*
What is the number of molecules in 250 cm^3 of oxygen under room conditions?

A 3.0×10^{26}
B 6.7×10^{21}
C 3.0×10^{22}
D 6.27×10^{21}

2 A pure hydrocarbon is used in bottled gas for cooking and heating. When 20 cm^3 of the hydrocarbon is burned in 160 cm^3 of oxygen (an excess), the final gaseous mixture contains 60 cm^3 of carbon dioxide and 60 cm^3 of unreacted oxygen. All gaseous volumes were measured under identical conditions. What is the formula of the hydrocarbon?

A C_3H_6
B C_2H_6
C C_4H_{10}
D C_3H_8

3 Use of the Data Booklet is relevant to this question. Most modern cars are fitted with airbags. These work by decomposing sodium azide to liberate nitrogen gas, which inflates the bag.
$2NaN_3 \rightarrow 3N_2 + 2Na$
A typical driver's airbag contains 50 g of sodium azide. Calculate the volume of nitrogen this will produce at room temperature.

A 9.2 dm^3
B 13.9 dm^3
C 27.7 dm^3
D 72.0 dm^3

4 Flask X contains 1.5 dm^3 of helium at 2 kPa pressure and flask Y contains 2 dm^3 of neon at 1.2 kPa pressure. If the flasks are connected at constant temperature, what is the final pressure?

A 0.857 kPa
B 0.685kPa
C 1.54kPa
D 1.83kPa

5 Which of the following solids has a simple molecular lattice?

A Sodium chloride
B Phosphorus
C Silicon
D Magnesium

6 $N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$ $\Delta H = +88\ kJ\ mol^{-1}$
$N_2(g) + 2O_2(g) \rightarrow N_2O_4(g)$ $\Delta H = +10\ kJ\ mol^{-1}$
The enthalpy change for the reaction $2NO_2(g) \rightarrow N_2O_4(g)$ will be

A $-78\ kJ\ mol^{-1}$
B $-98\ kJ\ mol^{-1}$
C $+78\ kJ\ mol^{-1}$
D $+98\ kJ\ mol^{-1}$

7

	ΔH / kJ mol^{-1}
$H_2S(g) \rightarrow H(g) + HS(g)$	+326
$HS(g) \rightarrow H(g) + S(g)$	+366

From the table given above, it follows that the mean bond energy, in kJ mol^{-1}, for the covalent bond between hydrogen and sulphur is

A +40
B +163
C +183
D +346

8 For which system does the equilibrium constant, K_c, have units of dm^3mol^{-1}?

A $2NO_2 \leftrightarrows N_2O_4$
B $H_2 + I_2 \leftrightarrows 2HI$
C $CH_4 + H_2O \leftrightarrows CO + 3H_2$
D $H_2O + CH_3CO_2C_2H_5 \leftrightarrows CH_3CO_2H + C_2H_5OH$

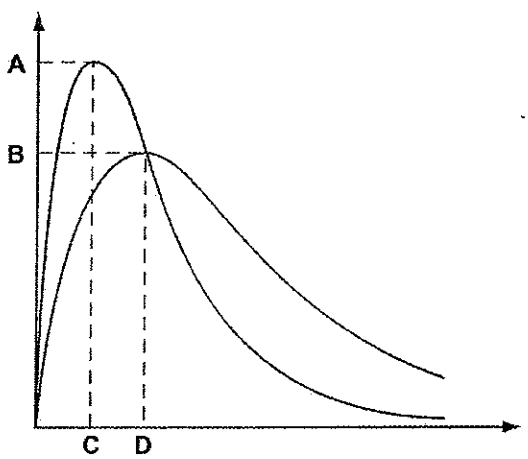
9 Methanol is manufactured industrially by the catalytic reaction shown.
$CO(g) + 2H_2(g) \rightarrow CH_3OH(g)$; $\Delta H = -92\ kJ\ mol^{-1}$
The operating conditions are:
250 °C, a pressure between 50 atm and 100 atm; a copper-based catalyst.
Which factor influences the choice of these conditions?

A The catalyst increases the equilibrium yield of methanol.
B At lower pressures, the rate of formation of methanol increases
C At lower temperatures, the equilibrium yield of methanol increases
D At lower temperatures, the rate of formation of methanol increases.

10 A mixture of gases contains 64 g of methane, 64 g of oxygen and 64 g of sulphur dioxide. The pressure of the mixture is 210 kPa.
What is the partial pressure (in kPa) of the methane expected to be?

A 30
B 60
C 70
D 120

11 The diagram shows the Maxwell-Boltzmann energy distribution curves for molecules of a sample of a gas at two different temperatures.
Which letter on the axes represents the most probable energy of the molecules at the higher temperature?

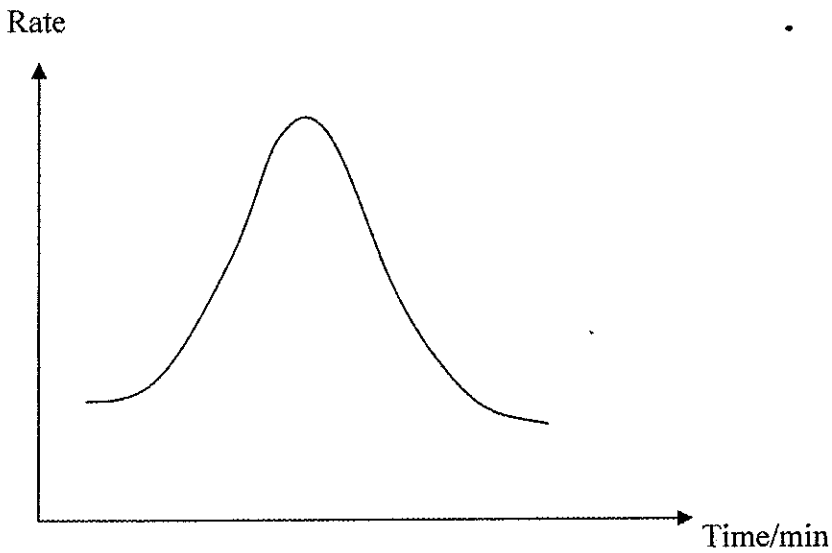


12 The reaction of manganate(VII) ions with ethanedioate ions in acid solution may be represented by the following equation.

$2MnO_4^-(aq) + 16H^+(aq) + 5C_2O_4^{2-}(aq) \rightarrow 2Mn^{2+}(aq) + 8H_2O(l) + 10\,CO_2(g)$

The graph shows concentration of manganate(VII) ions against time for this reaction.

What does the shape of the graph suggest about this reaction?



A It is exothermic.
B It is endothermic.
C It produces its own catalyst
D The rate of the reaction is constant.

13 X, Y and Z are elements in the same short period of the Periodic Table. The oxide of X is amphoteric, the oxide of Y is basic and the oxide of Z is acidic. What is the order of increasing atomic number for these elements?

A XYZ
B XZY
C YXZ
D YZX

14 The ions P^{3-}, S^{2-} and Cl^- have radii 0.212 nm, 0.184 nm and 0.181 nm respectively.
Which one of the following correctly explains the change in radius in going from P^{3-} to Cl^-?

A increasing in the total number of electrons and in the nuclear charge
B a constant total number of electrons and an increase in the nuclear charge
C an increase in the total number of electrons with the nuclear charge remaining constant.
D a decrease in the total number of electrons with the nuclear charge remaining constant.

15 Which one of the following properties of the Group II elements (magnesium to barium) and their compounds increases with increasing atomic number?

A the pH of the aqueous chloride
B the stability of the carbonate to heat
C the solubility of the sulphate in water
D the magnitude of the enthalpy change of hydration of the metal ion

16 For the sequence hydrogen chloride, hydrogen bromide and hydrogen iodide, there is a decrease in:

A thermal stability
B bond length
C strength of acidity
D ease of oxidation

17 Which one of the following statements is true?

A All nitrates of Group II metals are decomposed by heat to give the oxide, O_2 and NO_2.
B Aqueous sodium nitrate is acidic to litmus
C Aqueous ammonium nitrate is alkaline to litmus.
D All nitrates of group II metals are insoluble in water.

18 Several redox reactions involving hydrogen peroxide are shown below

Reaction I: $H_2O_2 + 2NO_2 \rightarrow 2HNO_3$
Reaction II: $4H_2O_2 + NH_4^+ \rightarrow HNO_3 + H^+ + 5H_2O$

What is the change in oxidation numbers of nitrogen in reaction I and II?

	change of oxidation number of N in reaction I	change of oxidation number of N in reaction II
A	+1	+1
B	+1	+8
C	+2	+4
D	+2	+3

19 The table shows the results of experiments in which the halogens X_2, Y_2 and Z_2 were added to separate aqueous solutions containing X^-, Y^- and Z^- ions.

	X^- (aq)	Y^- (aq)	Z^- (aq)
X_2	no reaction	no reaction	no reaction
Y_2	X_2 formed	no reaction	Z_2 formed
Z_2	X_2 formed	no reaction	no reaction

Which set contains the X_2, Y_2 and Z_2 halogens in order of their decreasing strength as an oxidizing agent?

	strongest		weakest
A	X_2	Y_2	Z_2
B	Y_2	X_2	Z_2
C	Y_2	Z_2	X_2
D	Z_2	X_2	Y_2

20 How many structural and *cis-trans* isomers are there for dichloropropene, $C_3H_2Cl_4$?

A 7
B 6
C 5
D 3

21 Which compound on reaction with hydrogen cyanide produces a compound with a chiral centre?

A CH_3COCH_3
B $CH_3CH_2CH_2COCH_2CH_3$
C $CH_3CO_2CH_3$
D HCHO

22 Which compound could not be obtained from cracking a sample of nonane, $CH_3(CH_2)_7CH_3$?

A $CH_3CH{=}CHCH{=}CHCH_2CH_2CH_3$
B $CH_3CH_2CH_2CH_3$
C $CH_3CH_2CH_2CH_2CH_2CH{=}CH_2$
D $(CH_3CH_2CH_2)_2C(CH_2CH_3)CH_3$

23 For which pair of compounds can the members be distinguished by means of Tollens' test (the use of a solution containing $Ag(NH_3)_2^+$)?

A CH_3COCH_3 and $CH_3CO_2CH_3$
B CH_3COCH_3 and $C_2H_5COCH_3$
C CH_3CH_2CHO and $CH_3CH_2COCH_3$
D CH_3CO_2H and $CH_3CO_2CH_3$

24 Which compound reacts with its own oxidation product (an oxidation which involves no loss of carbon) to give a sweet-smelling liquid?

A propanal
B propanoic acid
C butanone
D butan–1–ol

25 How many hydrogen atoms in a $HOCH_2CH(OH)COOH$ molecule, may be substituted by deuterium on dissolving it in an excess of D_2O?

A 2
B 3
C 5
D 6

26 Which reaction occurs with saturated hydrocarbons?

A catalytic cracking
B catalytic halogenations
C polymerisation
D oxidation

27 What is formed when propanal is refluxed with a solution of $NaBH_4$?

A propanone
B propan-1-ol
C propan-2-ol
D Propanoic acid

28 Which isomer of $C_5H_{12}O$ forms three alkenes on dehydration?

A pentan-1-ol
B pentan-2-ol
C 2-methylbutan-1-ol
D 2-methylbutan-2-ol

29 Which compound exhibits both cis-trans and optical isomerism?

A $CH_3CH{=}CHCH_2CH_2CH_3$
B $CH_3CH_2CHBrCH{=}CH_2$
C $CH_3CBr{=}CBrCH_3$
D $CH_3CH_2CH_2CHBrCH{=}CHBr$

30 Which ester is formed when the alcohol $CH_3CH_2CH_2OH$ is reacted with $CH_3CH_2CH_2CH_2CO_2H$?

A ethyl pentanoate
B pentyl propanoate
C propyl butanoate
D propyl pentanoate

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 (you may find it helpful to put a tick against the statements that 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

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

31 Semiconductors are now widely used in electronic devices. An element is a semiconductor if one of its electronic levels is fully occupied (such as an *s* level), but a level immediately above it is of only slightly higher energy (such as a *p* level) and is empty or only partially filled.
On this basis, which elements could be expected to be semiconductors?

1 ^{31}Ga
2 ^{32}Ge
3 ^{51}Sb

32 Which of the following reactions always have an exothermic enthalpy change?

1 atomisation
2 neutralisation
3 the condensation of steam

33 In which of the following equations is silicon (IV) oxide acting as a base?

1 $SiO_2 + 4HF \rightarrow 2H_2O + SiF_4$
2 $SiO_2 + 2NaOH \rightarrow Na_2SiO_3 + H_2O$
3 $SiO_2 + 2Mg \rightarrow Si + 2MgO$

34 The activation energy of a reaction is usually

1 unaffected by the presence of a catalyst
2 high for a reaction that takes place slowly
3 different for the forward reaction and backward reaction in an exothermic process.

35 Methane and nitrogen monoxide, NO_x, are emitted in car exhaust gases. In the atmosphere they react with hydroxyl radicals.

I $OH\bullet + CH_4 + O_2 \rightarrow CH_3O_2\bullet + H_2O$
II $2NO + CH_3O_2\bullet + O_2 \rightarrow HCHO + 2NO_2 + OH\bullet$

Which are correct statements about these reactions?

1 Oxygen gas is reduced in reaction I
2 Reaction I and II together are propagation steps of a chain reaction
3 Nitrogen monoxide is an oxidising agent in reaction II

36 Which of the following statements about the elements calcium, strontium and barium are correct?

1 aqueous solutions of their hydroxides have a pH greater than 7.
2 the elements react with cold water liberating hydrogen
3 their oxides are amphoteric

37 Which pairs of compounds have the same empirical formula?

1 ethene and cyclohexane
2 hexane and oct-1-ene
3 ethane and ethene

38 What can be produced when an aqueous solution of pentan-1-ol is heated with dilute acidified potassium manganate(VII)?

1 pentanal
2 pentanoic acid
3 pentanone

39 What type/s of reaction are undergone by 2-chlorobutane?

1 Elimination
2 Nucleophilic substitution
3 Free radical substitution

40 Fats and grease that build up on pans used in cooking are esters. Pans which are dirty from fats or grease may be cleaned by heating them with a reagent that will react with the ester group.

What may be used to clean such pans by this reaction?

1 Sodium hydroxide - NaOH
2 vinegar - aqueous ethanoic acid, CH_3CO_2H
3 baking powder - sodium hydrogencarbonate, $NaHCO_3$