Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

General Certificate of Education
June 2003
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

CHEMISTRY CHM6/W
Unit 6a Synoptic Assessment

Tuesday 24 June 2003 Morning Session

In addition to this paper you will require:
- an objective test answer sheet;
- a calculator.

Time allowed: 1 hour

Instructions
- Use a black ball-point pen. Do **not** use pencil.
- Fill in the boxes at the top of this page.
- Answer **all** 40 questions.
- For each item there are four responses. When you have selected the response which you think is the best answer to a question, mark this response on your answer sheet.
- Mark all responses as instructed on your answer sheet. If you wish to change your answer to a question, follow the instructions on your answer sheet.
- Do all rough work in this book, **not** on your answer sheet.
- Make sure that you hand in **both** your answer sheet **and** this question paper at the end of this examination.
- The Periodic Table/Data Sheet is provided on pages 3 and 4. Detach this perforated sheet at the start of the examination.

Information
- Each correct answer will score one mark. No deductions will be made for wrong answers.
- This paper carries 10 per cent of the total marks for Advanced Level.
- The following data may be required.
  Gas constant $R = 8.31\,\text{J}\,\text{K}^{-1}\,\text{mol}^{-1}$

Advice
- Do not spend too long on any question. If you have time at the end, go back and answer any question you missed out.

The Periodic Table of the Elements

■ The atomic numbers and approximate relative atomic masses shown in the table are for use in the examination unless stated otherwise in an individual question.

I	II										III	IV	V	VI	VII	0
1.0 **H** Hydrogen 1																4.0 **He** Helium 2
6.9 **Li** Lithium 3	9.0 **Be** Beryllium 4										10.8 **B** Boron 5	12.0 **C** Carbon 6	14.0 **N** Nitrogen 7	16.0 **O** Oxygen 8	19.0 **F** Fluorine 9	20.2 **Ne** Neon 10
23.0 **Na** Sodium 11	24.3 **Mg** Magnesium 12										27.0 **Al** Aluminium 13	28.1 **Si** Silicon 14	31.0 **P** Phosphorus 15	32.1 **S** Sulphur 16	35.5 **Cl** Chlorine 17	39.9 **Ar** Argon 18
39.1 **K** Potassium 19	40.1 **Ca** Calcium 20	45.0 **Sc** Scandium 21	47.9 **Ti** Titanium 22	50.9 **V** Vanadium 23	52.0 **Cr** Chromium 24	54.9 **Mn** Manganese 25	55.8 **Fe** Iron 26	58.9 **Co** Cobalt 27	58.7 **Ni** Nickel 28	63.5 **Cu** Copper 29	65.4 **Zn** Zinc 30	69.7 **Ga** Gallium 31	72.6 **Ge** Germanium 32	74.9 **As** Arsenic 33	79.0 **Se** Selenium 34	79.9 **Br** Bromine 35	83.8 **Kr** Krypton 36
85.5 **Rb** Rubidium 37	87.6 **Sr** Strontium 38	88.9 **Y** Yttrium 39	91.2 **Zr** Zirconium 40	92.9 **Nb** Niobium 41	95.9 **Mo** Molybdenum 42	98.9 **Tc** Technetium 43	101.1 **Ru** Ruthenium 44	102.9 **Rh** Rhodium 45	106.4 **Pd** Palladium 46	107.9 **Ag** Silver 47	112.4 **Cd** Cadmium 48	114.8 **In** Indium 49	118.7 **Sn** Tin 50	121.8 **Sb** Antimony 51	127.6 **Te** Tellurium 52	126.9 **I** Iodine 53	131.3 **Xe** Xenon 54
132.9 **Cs** Caesium 55	137.3 **Ba** Barium 56	138.9 **La** Lanthanum 57 *	178.5 **Hf** Hafnium 72	180.9 **Ta** Tantalum 73	183.9 **W** Tungsten 74	186.2 **Re** Rhenium 75	190.2 **Os** Osmium 76	192.2 **Ir** Iridium 77	195.1 **Pt** Platinum 78	197.0 **Au** Gold 79	200.6 **Hg** Mercury 80	204.4 **Tl** Thallium 81	207.2 **Pb** Lead 82	209.0 **Bi** Bismuth 83	210.0 **Po** Polonium 84	210.0 **At** Astatine 85	222.0 **Rn** Radon 86
223.0 **Fr** Francium 87	226.0 **Ra** Radium 88	227 **Ac** Actinium 89 †															

Key

relative atomic mass — 6.9 **Li** Lithium

atomic number — 3

140.1 **Ce** Cerium 58	140.9 **Pr** Praseodymium 59	144.2 **Nd** Neodymium 60	144.9 **Pm** Promethium 61	150.4 **Sm** Samarium 62	152.0 **Eu** Europium 63	157.3 **Gd** Gadolinium 64	158.9 **Tb** Terbium 65	162.5 **Dy** Dysprosium 66	164.9 **Ho** Holmium 67	167.3 **Er** Erbium 68	168.9 **Tm** Thulium 69	173.0 **Yb** Ytterbium 70	175.0 **Lu** Lutetium 71
232.0 **Th** Thorium 90	231.0 **Pa** Protactinium 91	238.0 **U** Uranium 92	237.0 **Np** Neptunium 93	239.1 **Pu** Plutonium 94	243.1 **Am** Americium 95	247.1 **Cm** Curium 96	247.1 **Bk** Berkelium 97	252.1 **Cf** Californium 98	(252) **Es** Einsteinium 99	(257) **Fm** Fermium 100	(258) **Md** Mendelevium 101	(259) **No** Nobelium 102	(260) **Lr** Lawrencium 103

* **58 – 71** Lanthanides

† **90 – 103** Actinides

Table 1
Proton n.m.r chemical shift data

Type of proton	**δ/ppm**
RCH_3	0.7–1.2
R_2CH_2	1.2–1.4
R_3CH	1.4–1.6
$RCOCH_3$	2.1–2.6
$ROCH_3$	3.1–3.9
$RCOOCH_3$	3.7–4.1
ROH	0.5–5.0

Table 2
Infra-red absorption data

Bond	**Wavenumber/cm^{-1}**
C—H	2850–3300
C—C	750–1100
C═C	1620–1680
C═O	1680–1750
C—O	1000–1300
O—H (alcohols)	3230–3550
O—H (acids)	2500–3000

Multiple choice questions

Each of Questions **1** to **20** consists of a question or an incomplete statement followed by four suggested answers or completions. You are to select the most appropriate answer in each case.

Questions 1 to 3

The ester methyl ethanoate is hydrolysed as shown in the following equation.

$$CH_3COOCH_3(l) + H_2O(l) \rightleftharpoons CH_3COOH(l) + CH_3OH(l) \qquad \Delta H^{\ominus} = +3\,kJ\,mol^{-1}$$

1 The equilibrium yield of ethanoic acid could be increased by

A lowering the temperature.

B adding a catalyst.

C adding more water to the reaction mixture.

D adding more methanol to the reaction mixture.

2 A 3 mol sample of methyl ethanoate was mixed with 3 mol of water and left to reach equilibrium at 298 K. The equilibrium yield of ethanoic acid was 2 mol.
The value of K_c for this reaction at 298 K is

A $\frac{2}{3}$

B $\frac{4}{9}$

C 2

D 4

3 Which one of the following compounds from the reaction mixture has no hydrogen bonding between its molecules when pure?

A $CH_3COOCH_3(l)$

B $H_2O(l)$

C $CH_3COOH(l)$

D $CH_3OH(l)$

Questions 4 and 5

Using the information below, answer Questions **4** and **5**.

$Fe_2O_3(s) + 3H_2(g) \longrightarrow 2Fe(s) + 3H_2O(g)$ $\quad \Delta H^{\ominus} = +96\ kJ\ mol^{-1}, \quad \Delta S^{\ominus} = +138\ J\ K^{-1}\ mol^{-1}$

	$Fe_2O_3(s)$	$H_2(g)$	Fe(s)
$\Delta H_f^{\ominus}$ / kJ mol^{-1}	−822.0	0	0
$S^{\ominus}$ / J K^{-1} mol^{-1}	90.0	131.0	27.0

4 The standard enthalpy of formation of steam is

A $+286\ kJ\ mol^{-1}$

B $+242\ kJ\ mol^{-1}$

C $-242\ kJ\ mol^{-1}$

D $-286\ kJ\ mol^{-1}$

5 The standard entropy value for steam is

A $+332\ J\ K^{-1}\ mol^{-1}$

B $+189\ J\ K^{-1}\ mol^{-1}$

C $+145\ J\ K^{-1}\ mol^{-1}$

D $+85\ J\ K^{-1}\ mol^{-1}$

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6 Ions of the two most common isotopes of the transition metal nickel are shown below.

$$^{58}_{28}Ni^{2+} \qquad\qquad ^{60}_{28}Ni^{2+}$$

Which one of the following statements is true?

A The electron arrangement of both these Ni^{2+} ions is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$.

B The $^{60}_{28}Ni^{2+}$ ion will have more protons in its nucleus than the $^{58}_{28}Ni^{2+}$ ion.

C In the same strength magnetic field, the $^{60}_{28}Ni^{2+}$ ion will be deflected more than the $^{58}_{28}Ni^{2+}$ ion.

D Both of these Ni^{2+} ions have the same number of electrons but a different number of neutrons.

7 Which one of the following statements about carbon monoxide is **not** true?

A It has a positive enthalpy of combustion.

B It is formed during the incomplete combustion of alkanes.

C It is oxidised to carbon dioxide when heated strongly with iron(III) oxide.

D Compared with an oxygen molecule, it can form a stronger co-ordinate bond with iron(II) in haemoglobin.

8 Which one of the following is **not** a redox reaction?

A $TiO_2 + 2Cl_2 + C \longrightarrow TiCl_4 + CO_2$

B $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$

C $MgO + 2HCl \longrightarrow MgCl_2 + H_2O$

D $3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$

9 Which one of the following could **not** act as a ligand?

A F^-

B CH_3CH_3

C NH_2NH_2

D CH_3OCH_3

10 In which one of the following reactions is H_2O_2 behaving as a reducing agent?

A $H_2O_2 + 2I^- + 2H^+ \longrightarrow I_2 + 2H_2O$

B $H_2O_2 + 2[Co(NH_3)_6]^{2+} \longrightarrow 2[Co(NH_3)_6]^{3+} + 2OH^-$

C $5H_2O_2 + 2MnO_4^- + 6H^+ \longrightarrow 2Mn^{2+} + 8H_2O + 5O_2$

D $3H_2O_2 + 2[Cr(OH)_6]^{3-} \longrightarrow 2CrO_4^{2-} + 8H_2O + 2OH^-$

11 In which one of the following reactions is there a decrease in entropy?

A $[Fe(H_2O)_6]^{3+}(aq) + 3C_2O_4^{2-}(aq) \longrightarrow [Fe(C_2O_4)_3]^{3-}(aq) + 6H_2O(l)$

B $[Cu(H_2O)_6]^{2+}(aq) + EDTA^{4-}(aq) \longrightarrow [Cu(EDTA)]^{2-}(aq) + 6H_2O(l)$

C $[CoCl_4]^{2-}(aq) + 6H_2O(l) \longrightarrow [Co(H_2O)_6]^{2+}(aq) + 4Cl^{-}(aq)$

D $Na_2CO_3(s) + 2H^{+}(aq) \longrightarrow 2Na^{+}(aq) + CO_2(g) + H_2O(l)$

12 When aqueous sodium hydroxide was added to an aqueous solution of **X**, a green precipitate, insoluble in an excess of aqueous sodium hydroxide, was formed. When aqueous barium nitrate was added to a second sample of aqueous **X**, a white precipitate was obtained. Which one of the following could be **X**?

A $FeCl_2$

B $FeSO_4$

C $CrCl_3$

D $Cr_2(SO_4)_3$

13 In the table below, which one of the following complex ions has a correct shape, co-ordination number and oxidation state?

	Complex	**Shape**	**Co-ordination number**	**Oxidation state of central cation**
A	$[Ag(CN)_2]^{-}$	Linear	2	–1
B	$[CuCl_4]^{2-}$	Tetrahedral	4	–2
C	$[Cr(C_2O_4)_3]^{3-}$	Octahedral	3	+3
D	$[Cu(NH_3)_4(H_2O)_2]^{2+}$	Octahedral	6	+2

14 Which one of the following will **not** reduce an acidified solution of potassium dichromate(VI)?

A $(CH_3)_2C(OH)CH_3$

B $FeSO_4$

C $CH_3CH_2CH(OH)CH_3$

D Zn

15 Butan-1-ol was converted into butyl propanoate by reaction with an excess of propanoic acid. In the reaction, 6.0 g of the alcohol gave 7.4 g of the ester. The percentage yield of ester was

A 57

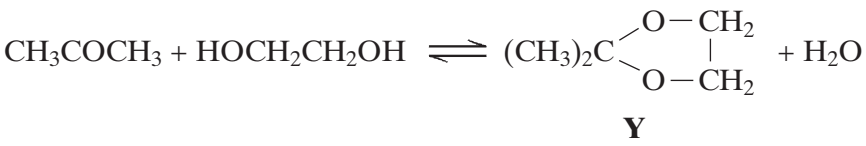
B 70

C 75

D 81

Questions 16 to 20

Questions **16** to **20** are about the reaction between propanone and an excess of ethane-1,2-diol, the equation for which is given below.



Y

In a typical procedure, a mixture of 1.00 g of propanone, 5.00 g of ethane-1,2-diol and 0.100 g of benzenesulphonic acid, $C_6H_5SO_3H$, is heated under reflux in an inert solvent. Benzenesulphonic acid is a strong acid.

16 The products would **not** have an absorption in the infra-red at

A $1050\,cm^{-1}$

B $1720\,cm^{-1}$

C $2950\,cm^{-1}$

D $3400\,cm^{-1}$

17 If 0.100 g of the strong monoprotic acid, benzenesulphonic acid, was dissolved in $100\,cm^3$ of water, the pH of the solution would be

A 0.20

B 1.20

C 2.20

D 3.20

18 If 1.00 g of propanone was vapourised at 100 °C and 100 kPa pressure, the volume in m^3 of gas formed would be

A 31.0

B 8.31

C 0.534

D 5.34×10^{-4}

19 When the concentration of benzenesulphonic acid is doubled, the rate of the reaction doubles. It can be deduced that

A the reaction is first order overall.

B the reaction is third order overall.

C the reaction is acid-catalysed.

D units for the rate constant, k, are $mol^{-2}\,dm^6\,s^{-1}$.

20 Which one of the following statements is **not** true?

A Ethane-1,2-diol and water can form hydrogen bonds.

B Ethane-1,2-diol is soluble in water.

C Propane has a higher boiling point than ethane-1,2-diol.

D **Y** and water are polar molecules.

Multiple completion questions
For each of Questions **21** to **40**, **one or more** of the options given may be correct. Select your answer by means of the following code.

A if (1), (2) and (3) only are correct.
B if (1) and (3) only are correct.
C if (2) and (4) only are correct.
D if (4) alone is correct.

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

Questions 21 and 22

The following information concerns the gas-phase formation of nitrogen monoxide.

$$\tfrac{1}{2}N_2(g) + \tfrac{1}{2}O_2(g) \rightleftharpoons NO(g) \qquad \Delta H^{\ominus} = +91\,kJ\,mol^{-1}$$

A series of experiments was carried out in a reaction vessel at constant temperature.
When the initial pressure of both gases was increased by a factor of 2, the initial rate of reaction increased by a factor of 8.
When the initial pressure of N_2 was doubled while that of O_2 remained constant, the initial rate of reaction increased by a factor of 2.

21 Which of the following statements is/are true?

(1) The reaction is first order with respect to nitrogen.

(2) The yield increases if the pressure is increased.

(3) The rate increases if the pressure is increased.

(4) The equilibrium constant decreases if the temperature is increased.

22 Which of the following statements is/are true?

(1) The equilibrium constant has the units $mol^{-1}\,dm^3$.

(2) Increasing the pressure of both gases by a factor of 3 increases the rate by a factor of 27.

(3) The equilibrium constant increases if the pressure is decreased.

(4) The rate constant has the units $mol^{-2}\,dm^6\,s^{-1}$.

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

23 This question concerns the cell

$$Mg(s) \mid Mg^{2+}(aq) \parallel Ca^{2+}(aq) \mid Ca(s)$$

The standard electrode potential of calcium is more negative than that of magnesium. Which of the following statements is/are true?

(1) The cell has a negative potential.

(2) Calcium is a stronger reducing agent than magnesium.

(3) Electrons flow from calcium to magnesium.

(4) Magnesium is more readily oxidised than calcium.

24 Which of the following do/does **not** involve a redox reaction?

(1) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

(2) $[V(H_2O)_4Cl_2]^+ + 2H_2O \longrightarrow [V(H_2O)_6]^{3+} + 2Cl^-$

(3) $TiCl_4 + 4Na \longrightarrow Ti + 4NaCl$

(4) $CaCO_3 + SiO_2 \longrightarrow CaSiO_3 + CO_2$

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

25 Use the information to deduce the true statement(s) below.

Half-equation	$E^{\ominus}$/**V**
$VO_2^+(aq) + 2H^+(aq) + e^- \longrightarrow VO^{2+}(aq) + H_2O(l)$	+1.00
$Fe^{3+}(aq) + e^- \longrightarrow Fe^{2+}(aq)$	+0.77
$VO^{2+}(aq) + 2H^+(aq) + e^- \longrightarrow V^{3+}(aq) + H_2O(l)$	+0.34
$V^{3+}(aq) + e^- \longrightarrow V^{2+}(aq)$	−0.26
$Zn^{2+}(aq) + 2e^- \longrightarrow Zn(s)$	−0.76

True statements include

(1) there are four different oxidation states of vanadium shown in the table above.

(2) $Zn^{2+}(aq)$ ions will oxidise $V^{2+}(aq)$ ions to $V^{3+}(aq)$ ions.

(3) an excess of zinc is capable of reducing $VO_2^+(aq)$ to $V^{2+}(aq)$ in acidic conditions.

(4) $Fe^{3+}(aq)$ is capable of oxidising $V^{2+}(aq)$ to $VO_2^+(aq)$ in acidic conditions.

26 Boron trifluoride can form a co-ordinate bond with

(1) $CH_3CH_2CH_3$

(2) $CH_3CH_2CH_2NH_2$

(3) $(CH_3)_4Si$

(4) CH_3COCH_3

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

Questions 27 and 28

Consider the following equations.

$Na(s) + \frac{1}{2}Cl_2(g) \longrightarrow NaCl(s)$	ΔH_1
$Na(g) \longrightarrow Na^+(g) + e^-$	ΔH_2
$Cl(g) + e^- \longrightarrow Cl^-(g)$	ΔH_3
$Cl_2(g) \longrightarrow 2Cl(g)$	ΔH_4
$CH_4(g) \longrightarrow CH_3(g) + H(g)$	ΔH_5
$Na(s) \longrightarrow Na(g)$	ΔH_6
$Na^+(g) + Cl^-(g) \longrightarrow NaCl(s)$	ΔH_7
$Na^+(g) \longrightarrow Na^+(aq)$	ΔH_8
$Cl^-(g) \longrightarrow Cl^-(aq)$	ΔH_9
$NaCl(s) \longrightarrow Na^+(aq) + Cl^-(aq)$	ΔH_{10}

27 Enthalpy changes which represent enthalpies of formation, enthalpies of bond dissociation or enthalpies of hydration include

(1) ΔH_1, ΔH_5 and ΔH_{10}

(2) ΔH_4, ΔH_6, ΔH_7 and ΔH_9

(3) ΔH_4, ΔH_5, ΔH_7 and ΔH_8

(4) ΔH_1, ΔH_4, ΔH_5 and ΔH_8

28 In the calculation of the lattice enthalpy of NaCl using the Born–Haber cycle, the following are among the enthalpy values that are used.

(1) ΔH_2, ΔH_3, ΔH_4 and ΔH_{10}

(2) ΔH_1, ΔH_2, ΔH_3 and ΔH_4

(3) ΔH_1, ΔH_2, ΔH_3 and ΔH_7

(4) ΔH_1, ΔH_3, ΔH_4 and ΔH_6

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

29 The indicated element increases its oxidation state from left to right in the series

(1) vanadium in VO_2^+, VO^{2+}, V^{3+}

(2) chlorine in ClO^-, ClO_3^-, ClO_4^-

(3) chromium in $[Cr(H_2O)_6]^{3+}$, CrO_4^{2-}, $Cr_2O_7^{2-}$

(4) manganese in MnO_2, MnO_4^{2-}, MnO_4^-

30 Which of the following is/are correct statements?

(1) The reaction between iodide ions and concentrated sulphuric acid can result in the oxidation state of sulphur being decreased from +6 to –2.

(2) The magnitude of the lattice enthalpy of three Group I halides decreases in the order NaF > NaCl > KCl.

(3) Solid PCl_5 contains a tetrahedral ion and an octahedral ion.

(4) The strength of the metallic bonding in a Group in the Periodic Table increases as the size of the atoms increases.

TURN OVER FOR THE NEXT QUESTION

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

Questions 31 and 32

Consider the following elements, all in the same row of the Periodic Table.

Ca Ti Co Ge As Se

Use your knowledge of Period 3 and transition metals to answer the questions.

31 Which of the following has/have only two unpaired electrons in an uncombined atom?

(1) Ca

(2) Ti

(3) As

(4) Se

32 Which of the following has/have a maximum oxidation state of +4?

(1) Ti

(2) Co

(3) Ge

(4) Se

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33 True statements about 1,2-diaminoethane, $H_2NCH_2CH_2NH_2$, include

(1) it reacts with aqueous chromium(III) chloride to produce the complex ion $[Cr(H_2NCH_2CH_2NH_2)_3]^{3+}$

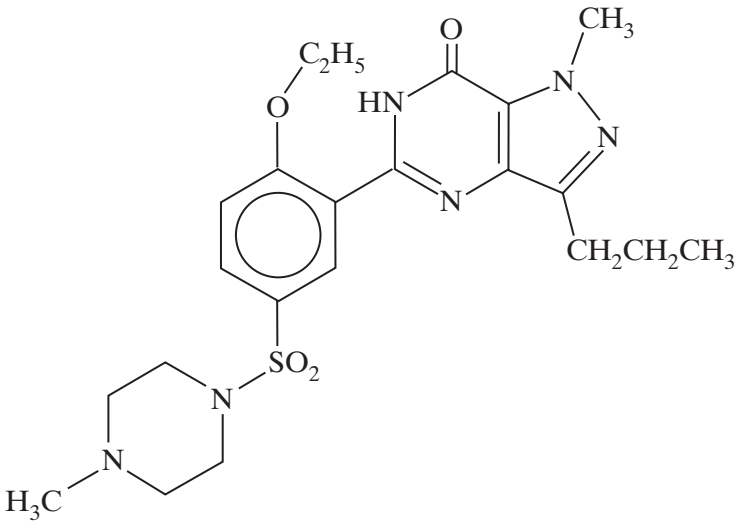
(2) it reacts with dilute hydrochloric acid to form the salt $[H_3NCH_2CH_2NH_3]^{2+}(Cl^-)_2$

(3) it reacts with ethanoyl chloride to form $CH_3CONHCH_2CH_2NHCOCH_3$

(4) it reacts with benzene-1,4-dicarboxylic acid to form an addition polymer.

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

34 Viagra has the following structure.



True statements about Viagra include

(1) it can undergo Friedel–Crafts reactions.

(2) it can undergo condensation polymerisation.

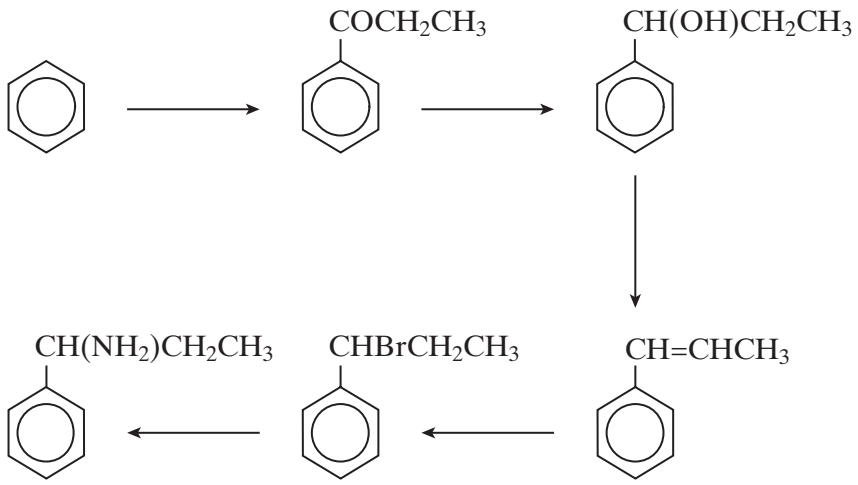
(3) it is soluble in dilute hydrochloric acid.

(4) it exhibits optical isomerism.

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

Questions 35 and 36

Questions **35** and **36** refer to the following reaction sequence.



35 Types of reaction involved in the above sequence include

(1) acylation

(2) dehydration

(3) reduction

(4) hydrolysis

36 Types of mechanism involved in the above sequence include

(1) electrophilic substitution

(2) electrophilic addition

(3) nucleophilic substitution

(4) nucleophilic addition–elimination

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

37 Four pairs of reagents are listed below. Which of the statements about the spectra of the organic products of these reactions is/are correct?

	Reagents	**Statement about the spectrum of the organic product**
(1)	Ethanoyl chloride and methanol	The proton n.m.r. spectrum consists of two singlets only
(2)	Epoxyethane and methanol	The proton n.m.r. spectrum contains a doublet at δ 2.5 ppm
(3)	Propan-2-ol and concentrated sulphuric acid	The i.r. spectrum contains an absorption at 1650 cm^{-1}
(4)	Ethanal and Tollens' reagent	The i.r. spectrum contains an absorption at 3340 cm^{-1}

38 Correct statements about nitriles include

(1) they are formed by reaction of a haloalkane with KCN.

(2) they react with hydrogen in the presence of a nickel catalyst to form primary amines.

(3) they react with aqueous sulphuric acid to form carboxylic acids.

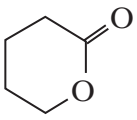
(4) they react with an excess of ammonia to form quaternary ammonium salts.

39 Correct statements about $CH_3CH_2CH{=}CHCOOH$ include

(1) it can be formed by oxidation of pent-3-en-1-ol.

(2) it forms an addition polymer.

(3) it exists as two optical isomers.

(4) it is a structural isomer of 

Directions summarised			
A	**B**	**C**	**D**
(1), (2) and (3) only correct	(1) and (3) only correct	(2) and (4) only correct	(4) only correct

40 The compound $LiCH_3$ is a useful reagent in organic chemistry. It can be considered to act as a source of CH_3^- ions.

Predict which of the following organic compounds would be attacked by a CH_3^- ion.

(1) bromoethane

(2) ethene

(3) propanone

(4) benzene

END OF QUESTIONS