

CHEMISTRY 1B - CHEM1102FIRST SEMESTER EXAMINATION**CONFIDENTIAL****JUNE 2003****TIME ALLOWED: THREE HOURS**

GIVE THE FOLLOWING INFORMATION IN BLOCK LETTERS

FAMILY NAME		SID NUMBER	
OTHER NAMES		TABLE NUMBER	

INSTRUCTIONS TO CANDIDATES

- All questions are to be attempted. There are 15 pages of examinable material.
- Complete the written section of the examination paper in **INK**.
- Read each question carefully. Report the appropriate answer and show all relevant working in the space provided.
- The total score for this paper is 100. The possible score per page is shown in the adjacent tables.
- Each new question of the short answer section begins with a •.
- Electronic calculators, including programmable calculators, may be used. Students are warned, however, that credit may not be given, even for a correct answer, where there is insufficient evidence of the working required to obtain the solution.
- Numerical values required for any question and a Periodic Table may be found on a separate data sheet.
- Pages 5, 15, 17 & 20 are for rough working only.

OFFICIAL USE ONLY**Multiple choice section**

	Marks	
Pages	Max	Gained
2-11	50	

Short answer section

Page	Marks		Marker
	Max	Gained	
12	7		
13	7		
14	8		
16	12		
18	8		
19	8		
Total	50		
Check Total			

Marks
5

- Write balanced net ionic equations for each of the following reactions. If there is no reaction then write "no reaction".

A solution of $\text{Ba}(\text{NO}_3)_2$ is added to a solution of Na_2SO_4 .

A solution of NaCl is added to a solution of AgNO_3 .

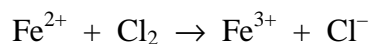
A solution of $\text{Pb}(\text{NO}_3)_2$ is added to an acidified solution of KI .

A 2 M solution of NH_3 is added to a 0.1 M solution of $\text{Cu}(\text{NO}_3)_2$.

$\text{H}_2\text{S}(\text{g})$ is bubbled through a solution of ZnSO_4 in the presence of 4 M HCl .

2

- Write the fully balanced equation for the redox reaction that occurs when chlorine gas is bubbled through a solution of iron(II) sulfate. The unbalanced equation is given.



Use the half-equation method: write both the oxidation and reduction half equations and the final balanced equation.

Oxidation half equation

Reduction half equation

Overall reaction

Marks
4

- Titanium(IV) chloride dissolves in concentrated hydrochloric acid to give the complex ion $[\text{TiCl}_6]^{2-}$.

What is the oxidation number of the titanium in $[\text{TiCl}_6]^{2-}$?

What is the coordination number of the titanium in $[\text{TiCl}_6]^{2-}$?

What is the shape of the $[\text{TiCl}_6]^{2-}$ ion?

Write the electron configuration for the titanium ion present in the $[\text{TiCl}_6]^{2-}$ ion.

Write the name of the $[\text{TiCl}_6]^{2-}$ ion.

3

- Magnesium metal can be produced by electrolysis of molten magnesium chloride. What mass (in gram) of magnesium would be produced by the passage of a current of 8.3 A for 1.8 hours?

ANSWER:

- The solubility product constant of BaSO_4 is $1.1 \times 10^{-10} \text{ M}^2$. What is the solubility of BaSO_4 in g L^{-1} ?

Marks
3

ANSWER:

- The solubility product constant of Ag_2CrO_4 is $2.6 \times 10^{-12} \text{ M}^3$. What is the molar solubility of Ag_2CrO_4 in water?

5

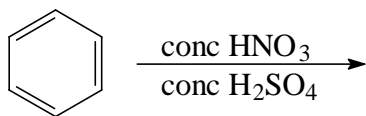
ANSWER:

What is the molar solubility of Ag_2CrO_4 in a solution of 0.10 M AgNO_3 ?

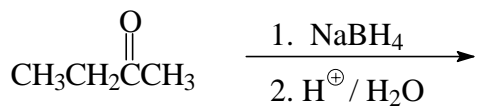
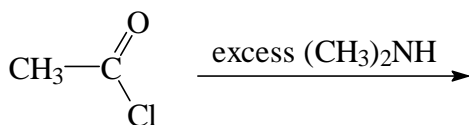
ANSWER:

Marks
12

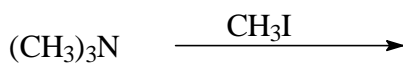
- Give the constitutional formulas and the name(s), where required, of the major organic product(s) of each of the following reactions.



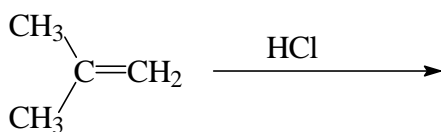
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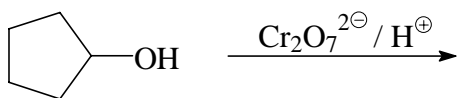
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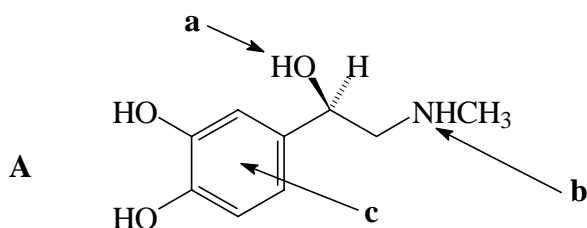
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Name:

- Adrenaline (**A**) is produced by the body as part of its “flight or fight” response.

Marks
6



- On the above diagram, clearly mark the stereogenic centre in (**A**) with an asterisk (*).
- List the substituents attached to the stereogenic centre in descending order of priority according to the sequence rules.

highest priority			lowest priority

- What is the absolute stereochemistry of adrenaline (**A**)? Write (*R*) or (*S*).

- Name the functional groups **a**, **b** and **c**, present in adrenaline (**A**)?

a =

b =

c =

- Give the stick representation of the product formed when bromine reacts with 2-methylbutene.

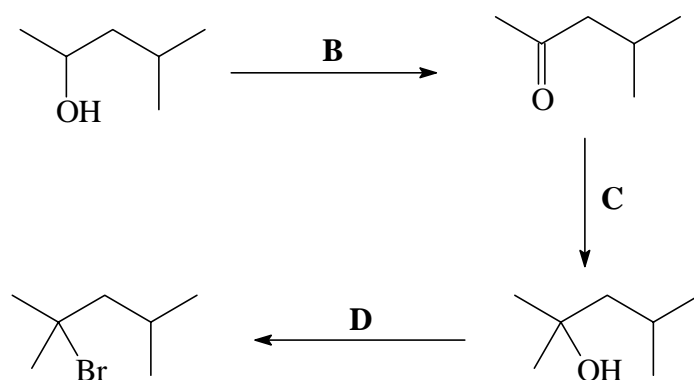
2



State whether the product formed by this reaction is *achiral*, the (*S*)-*enantiomer*, the (*R*)-*enantiomer*, a *meso*-compound or a *racemic mixture*?

- Give the conditions and reagents **B**, **C** and **D**, involved in the following conversion.

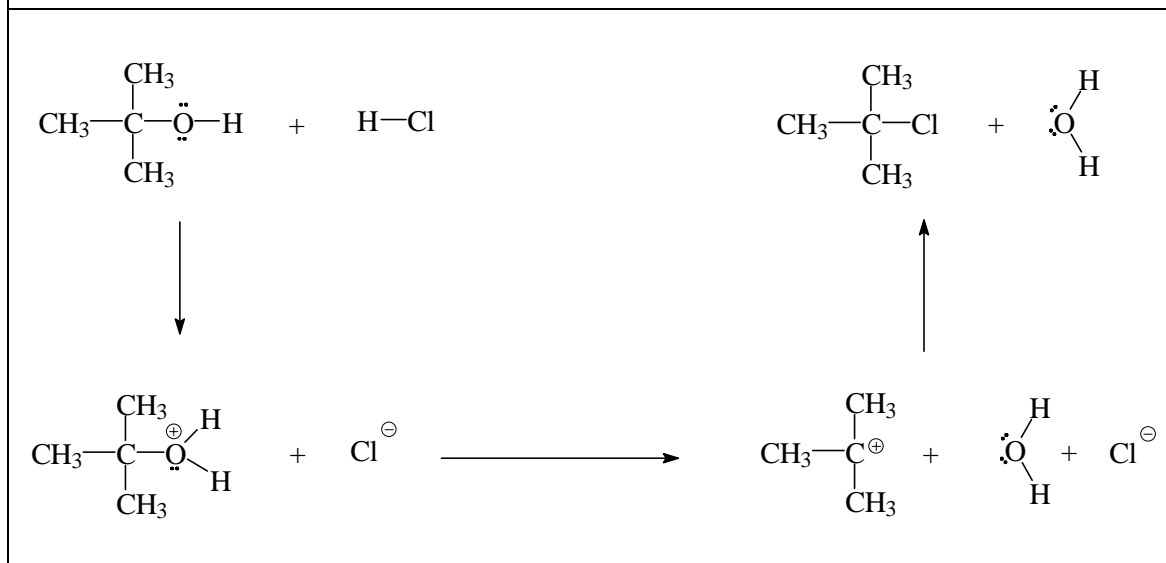
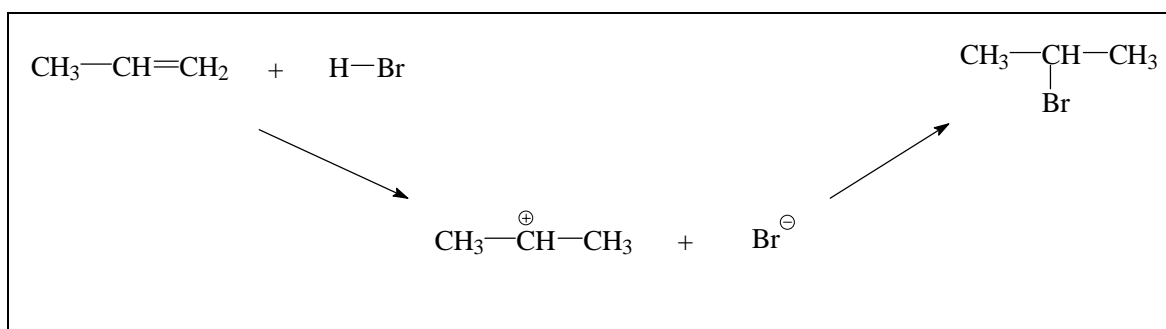
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3



B	C	D
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- Use curly arrow notation to illustrate the mechanism of each of the following reactions.

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Numerical Data

Physical constants

$$\text{Planck constant} = h = 6.626 \times 10^{-34} \text{ J s}$$

$$\text{Speed of light in vacuum} = c_0 = 2.998 \times 10^8 \text{ m s}^{-1}$$

$$\text{Avogadro constant} = N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$$

$$\text{Faraday constant} = F = 96485 \text{ C mol}^{-1}$$

$$\begin{aligned} \text{Ideal gas constant} = R &= 8.314 \text{ J K}^{-1} \text{ mol}^{-1} \\ &= 0.08206 \text{ L atm K}^{-1} \text{ mol}^{-1} \end{aligned}$$

$$\text{Volume of 1 mol of ideal gas at 1 atm, } 0^\circ\text{C} = 22.4 \text{ L}$$

$$\text{Volume of 1 mol of ideal gas at 1 atm, } 25^\circ\text{C} = 24.5 \text{ L}$$

Conversion factors

$$0^\circ\text{C} = 273 \text{ K}$$

$$1 \text{ atm} = 101.3 \text{ kPa} = 760.0 \text{ mmHg}$$

$$1 \text{ nm} = 10^{-9} \text{ m}$$

$$1 \text{ MHz} = 10^6 \text{ Hz} = 10^6 \text{ s}^{-1}$$

$$1 \text{ L} = 10^{-3} \text{ m}^3$$

**A periodic table is printed on the other side of this data sheet.
Atomic weights are included in the periodic table.**

PERIODIC TABLE OF THE ELEMENTS

June 2003

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 HYDROGEN H 1.008																	2 HELIUM He 4.003
3 LITHIUM Li 6.941	4 BERYLLIUM Be 9.012											5 BORON B 10.81	6 CARBON C 12.01	7 NITROGEN N 14.01	8 OXYGEN O 16.00	9 FLUORINE F 19.00	10 NEON Ne 20.18
11 SODIUM Na 22.99	12 MAGNESIUM Mg 24.31											13 ALUMINIUM Al 26.98	14 SILICON Si 28.09	15 PHOSPHORUS P 30.97	16 SULFUR S 32.07	17 CHLORINE Cl 35.45	18 ARGON Ar 39.95
19 POTASSIUM K 39.10	20 CALCIUM Ca 40.08	21 SCANDIUM Sc 44.96	22 TITANIUM Ti 47.88	23 VANADIUM V 50.94	24 CHROMIUM Cr 52.00	25 MANGANESE Mn 54.94	26 IRON Fe 55.85	27 COBALT Co 58.93	28 NICKEL Ni 58.69	29 COPPER Cu 63.55	30 ZINC Zn 65.39	31 GALLIUM Ga 69.72	32 GERMANIUM Ge 72.59	33 ARSENIC As 74.92	34 SELENIUM Se 78.96	35 BROMINE Br 79.90	36 KRYPTON Kr 83.80
37 RUBIDIUM Rb 85.47	38 STRONTIUM Sr 87.62	39 YTRIUM Y 88.91	40 ZIRCONIUM Zr 91.22	41 NIوبيUM Nb 92.91	42 MOLYBDENUM Mo 95.94	43 TECHNETIUM Tc [98.91]	44 RUTHENIUM Ru 101.07	45 RHODIUM Rh 102.91	46 PALLADIUM Pd 106.4	47 SILVER Ag 107.87	48 CADMIUM Cd 112.40	49 INDIUM In 114.82	50 TIN Sn 118.69	51 ANTIMONY Sb 121.75	52 TELLURIUM Te 127.60	53 IODINE I 126.90	54 XENON Xe 131.30
55 CAESIUM Cs 132.91	56 BARIUM Ba 137.34	57-71	72 HAFNIUM Hf 178.49	73 TANTALUM Ta 180.95	74 TUNGSTEN W 183.85	75 RHENIUM Re 186.2	76 OSMIUM Os 190.2	77 IRIDIUM Ir 192.22	78 PLATINUM Pt 195.09	79 GOLD Au 196.97	80 MERCURY Hg 200.59	81 THALLIUM Tl 204.37	82 LEAD Pb 207.2	83 BISMUTH Bi 208.98	84 POLONIUM Po [210.0]	85 ASTATINE At [210.0]	86 RADON Rn [222.0]
87 FRANCIUM Fr [223.0]	88 RADIUM Ra [226.0]	89-103	104 RUTHERFORDIUM Rf [261]	105 DUBNIUM Db [262]	106 SEABORGIUM Sg [266]	107 BOHRIUM Bh [262]	108 HASSIUM Hs [265]	109 MEITNERIUM Mt [266]									

LANTHANIDES

57 LANTHANUM La 138.91	58 CERIUM Ce 140.12	59 PRASEODYMIUM Pr 140.91	60 NEODYMIUM Nd 144.24	61 PROMETHIUM Pm [144.9]	62 SAMARIUM Sm 150.4	63 EUROPIUM Eu 151.96	64 GADOLINIUM Gd 157.25	65 TERBIUM Tb 158.93	66 DYSPROSIUM Dy 162.50	67 HOLMIUM Ho 164.93	68 ERBIUM Er 167.26	69 THULIUM Tm 168.93	70 YTTERBIUM Yb 173.04	71 LUTETIUM Lu 174.97
89 ACTINIUM Ac [227.0]	90 THORIUM Th 232.04	91 PROTACTINIUM Pa [231.0]	92 URANIUM U 238.03	93 NEPTUNIUM Np [237.0]	94 PLUTONIUM Pu [239.1]	95 AMERICIUM Am [243.1]	96 CURIUM Cm [247.1]	97 BERKELIUM Bk [247.1]	98 CALIFORNIUM Cf [252.1]	99 EINSTEINIUM Es [252.1]	100 FERMIUM Fm [257.1]	101 MENDELEVIUM Md [256.1]	102 NOBELIUM No [259.1]	103 LAWRENCIUM Lr [260.1]

ACTINIDES

22/07(b)