OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

Advanced GCE

CHEMISTRY B (SALTERS)

F335 QP

Unit F335: Chemistry by Design

Specimen Paper

Candidates answer on the question paper.

Time: 2 hours

Additional Materials:
Data Sheet for Chemistry B (Salters) (Inserted)
Scientific calculator

Candidate Name	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use a scientific calculator.
- A copy of the *Data Sheet for Chemistry B (Salters)* is provided as an insert with this question paper.
- You are advised to show all the steps in any calculations.
- The total number of marks for this paper is **120**.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**24**	
2	**22**	
3	**29**	
4	**29**	
5	**16**	
TOTAL	**120**	

Answer **all** the questions.

1 Hydrogen is used to make ammonia, an important agricultural chemical.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \textbf{equation 1.1}$$

Ammonia is used to make fertilisers.

(a) (i) Suggest the cheapest source for the nitrogen gas used in **equation 1.1**.

..... **[1]**

(ii) Ammonium nitrate, NH_4NO_3, is a fertiliser made from ammonia.

Calculate the percentage by mass of nitrogen in NH_4NO_3.

answer = ...% **[2]**

(iii) Ammonium sulfate is another fertiliser.

Write the formula of ammonium sulfate.

..... **[1]**

(iv) Explain **one** advantage and **one** disadvantage of adding ammonium salts to the soil.

.....

.....

.....

..... **[2]**

(b) Hydrogen is produced industrially from methane by *steam reforming* as shown below.

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g) \qquad \textbf{equation 1.2}$$

(i) Write an expression for K_c for the reaction in **equation 1.2**.

[2]

(ii) At the temperature of the reaction, K_p = 292 mol^2 dm^{-6}. The concentrations of some of the gases present in an equilibrium mixture at this temperature were measured and are given in the table below.

gas	concentration/ mol dm^{-3}
CH_4	5.00
H_2O	5.00
H_2	12.0

Calculate the concentration of carbon monoxide under these conditions.

Give your answer to a **suitable** number of significant figures.

[CO] = ...mol dm^{-3} **[3]**

(c) **(i)** Use le Chatelier's principle to predict the effect of **decreasing** the pressure on the yield of hydrogen in **equation 1.2**.

.....

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..... **[3]**

(ii) Suggest a reason why a pressure of around 30 atm is actually used for the process.

.....

..... **[1]**

$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$ **equation 1.2**

(d) The mixture of gases from the reaction in **equation 1.2** is mixed with more steam and passed over a hot iron catalyst. The carbon monoxide is converted to carbon dioxide.

(i) Write an equation for the reaction of carbon monoxide with steam.

[1]

(ii) Suggest **two** reasons why the carbon monoxide is **not** released into the atmosphere.

.....

.....

..... **[2]**

(e) **(i)** Predict the sign of ΔS_{sys} for the forward reaction in **equation 1.2**. Explain your reasoning.

.....

.....

..... **[1]**

(ii) Use the entropy data given in the table below to calculate the value of ΔS_{sys} (with the correct **sign**) for the forward reaction in **equation 1.2**.

compound	***S*/J K^{-1} mol^{-1}**
$CH_4(g)$	+186
$H_2O(g)$	+189
$CO(g)$	+198
$H_2(g)$	+131

ΔS_{sys} ..... J K^{-1} mol^{-1} **[3]**

(iii) At 500 K the value of ΔS_{tot} for the forward reaction is –1784.

Calculate the value of ΔS_{tot} at 1000 K.

Assume that ΔS_{sys} does not change with temperature.

ΔS_{tot} = ... J K^{-1} mol^{-1} **[2]**

[Total: 24]

2 The pigment *chrome yellow* consists of lead chromate(VI), $PbCrO_4$. It is made by precipitation when solutions of lead nitrate and sodium chromate(VI) are mixed.

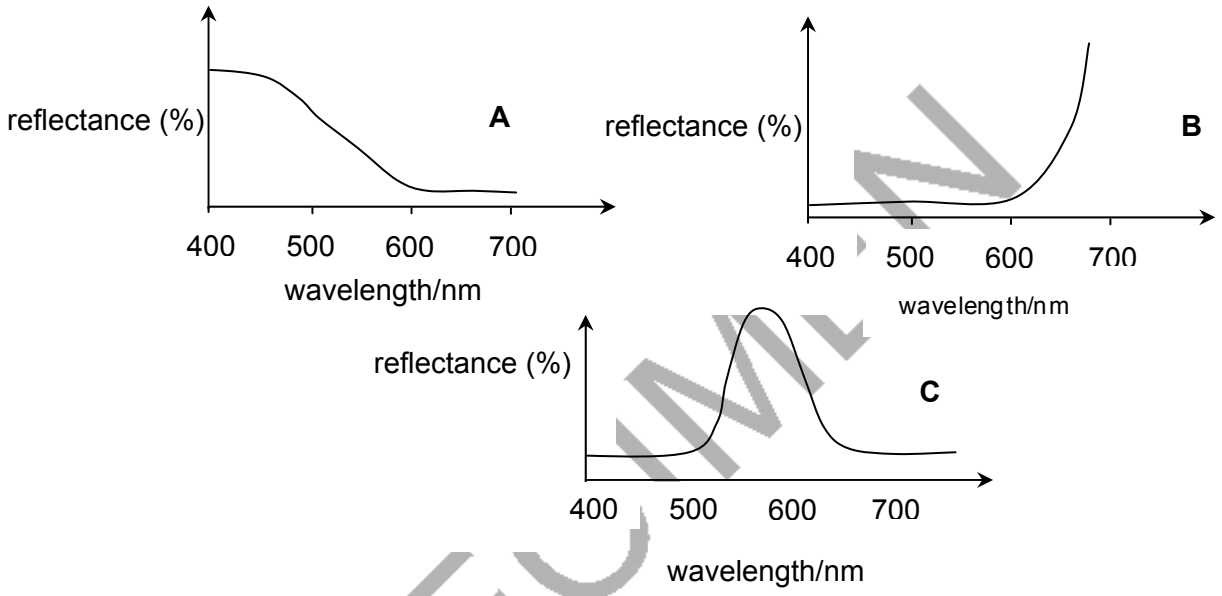
(a) Explain why (VI) is used to describe the CrO_4^{2-} ion.

..... **[1]**

(b) Write an **ionic** equation for the precipitation of lead chromate(VI), showing state symbols.

[2]

(c) Pigments can be identified by their visible reflectance spectra. The spectra of three pigments are shown below, lettered **A**, **B** and **C**.



Suggest, with a reason, which is the reflectance spectrum of chrome yellow.

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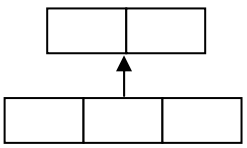
..... **[2]**

(d) The diagram below helps to explain the yellow colour of the chromate ion.



(i) Which electron sub-shell is shown in the diagram?

..... **[1]**

(ii) What causes the splitting of the orbitals within the sub-shell?

..... **[1]**

[Turn over

(e) A painting is being analysed. Four yellow pigments it might contain are shown below.

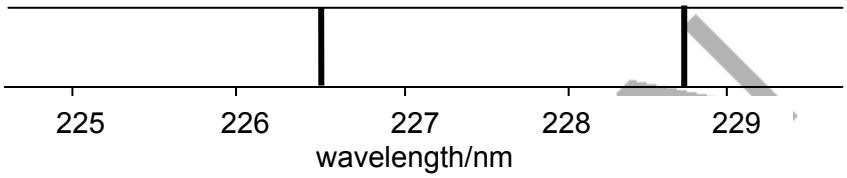
- barium yellow, $BaCrO_4$
- cadmium yellow, CdS
- orpiment, As_2S_3
- yellow ochre, containing Fe_2O_3

(i) Give the systematic name of the compound contained in yellow ochre.

..... **[1]**

(ii) One method of identifying pigments is to use atomic emission spectroscopy.

Part of a simplified atomic emission spectrum of the pigment is shown below.



Explain why the emissions occur at specific frequencies.

Include a diagram in your answer.

In your answer, you should make clear how the observed effect depends on the explanation.

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.....

.....

..... **[4]**

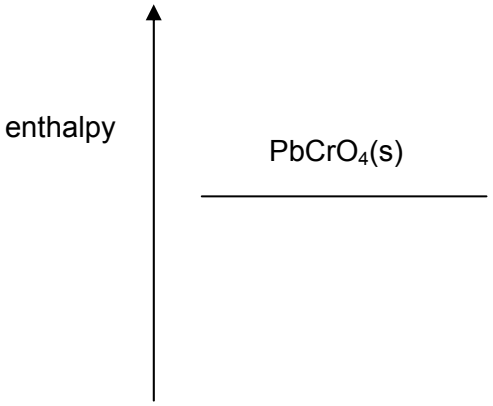
(iii) Use the data in the table below to identify the element and hence the **systematic name** of the pigment.

element	**certain characteristic emissions/nm**
Ba	233.5
Cd	228.8 226.5
As	228.8 235.0
Fe	238.2 239.7

element is ..... systematic name of pigment is ..... **[2]**

(f) Lead chromate(VI) is insoluble because it has an enthalpy change of solution of +17 kJ mol^{-1}. An estimate of the lattice enthalpy of lead chromate is –1000 kJ mol^{-1}.

(i) Complete the diagram to illustrate this by drawing and labelling suitable enthalpy levels and inserting the given values. Then use your diagram to calculate the sum of the enthalpy changes of hydration of the lead and chromate ions.



[3]

sum of enthalpy changes of hydration = ... kJ mol^{-1} **[1]**

(ii) Explain, in terms of bonds broken and made, the endothermic nature of this dissolving process, naming the bonds involved.

In your answer, you should use appropriate technical terms, spelled correctly.

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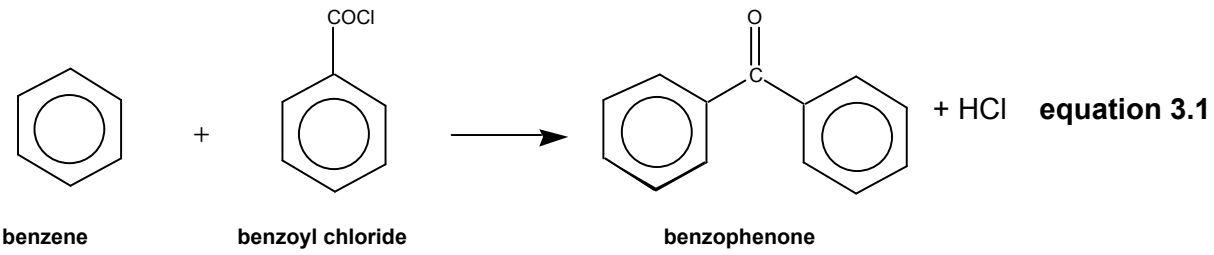
..... **[4]**

[Total: 22]

3 The compound benzophenone is used in cosmetics and as a sunscreen. It can be prepared in the laboratory by the following reaction in the presence of an aluminium chloride catalyst.



equation 3.1

benzene **benzoyl chloride** **benzophenone**

(a) (i) Draw the **full structural formula** for the acyl chloride group in **benzoyl chloride**.

[1]

(ii) Name the **reaction mechanism** by which benzene reacts in **equation 3.1**.

..... **[2]**

(b) An alternative way of representing the structure of **benzene** is shown as **representation 1** below.

representation 1 **representation 2**

Give reasons why **representation 2** is sometimes preferred. Give **one** reason in terms of the shape of the molecule and **one** reason in terms of its chemical properties.

shape.....

.....

chemical properties .....

..... **[2]**

(c) Sunscreens absorb ultraviolet radiation.

Explain, in terms of electronic energy levels, why a substance such as benzophenone absorbs in the ultraviolet but is not coloured.

In your answer, you should make clear how your explanation links with what is observed.

.....

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.....

.....

..... **[5]**

(d) The most effective way of removing the aluminium chloride at the end of the reaction is to hydrolyse it with water and to run it to waste.

$$AlCl_3(s) + 3H_2O(l) \rightarrow Al(OH)_3(s) + 3HCl(aq)$$

In the 1980s, benzophenone was made industrially by this method. Suggest and explain **two** reasons why this could lead to environmental hazards.

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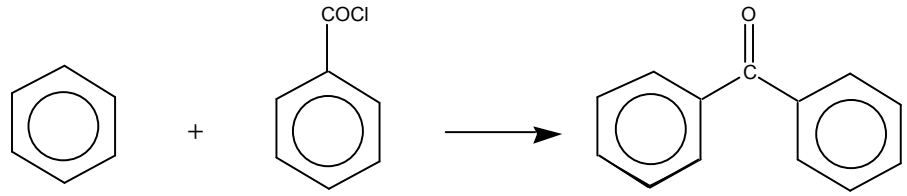
..... **[4]**



+ HCl **equation 3.1**

benzene **benzoyl chloride** **benzophenone**

(e) More recently, benzophenone has been prepared using another metal catalyst and a solvent that is an ionic liquid. A very high percentage yield is achieved and the catalyst and the solvent can be recycled.

(i) Explain the meaning of the term *ionic liquid.*

.....

..... **[1]**

(ii) If the percentage yield were 100%, calculate the maximum mass of benzophenone that could be produced from 10 kg of **benzene**.

answer = ... kg **[2]**

(iii) Calculate the atom economy of the reaction in **equation 3.1**.

answer = ... % **[2]**

(iv) Explain the importance to society and the environment of using the modern method of making benzophenone.

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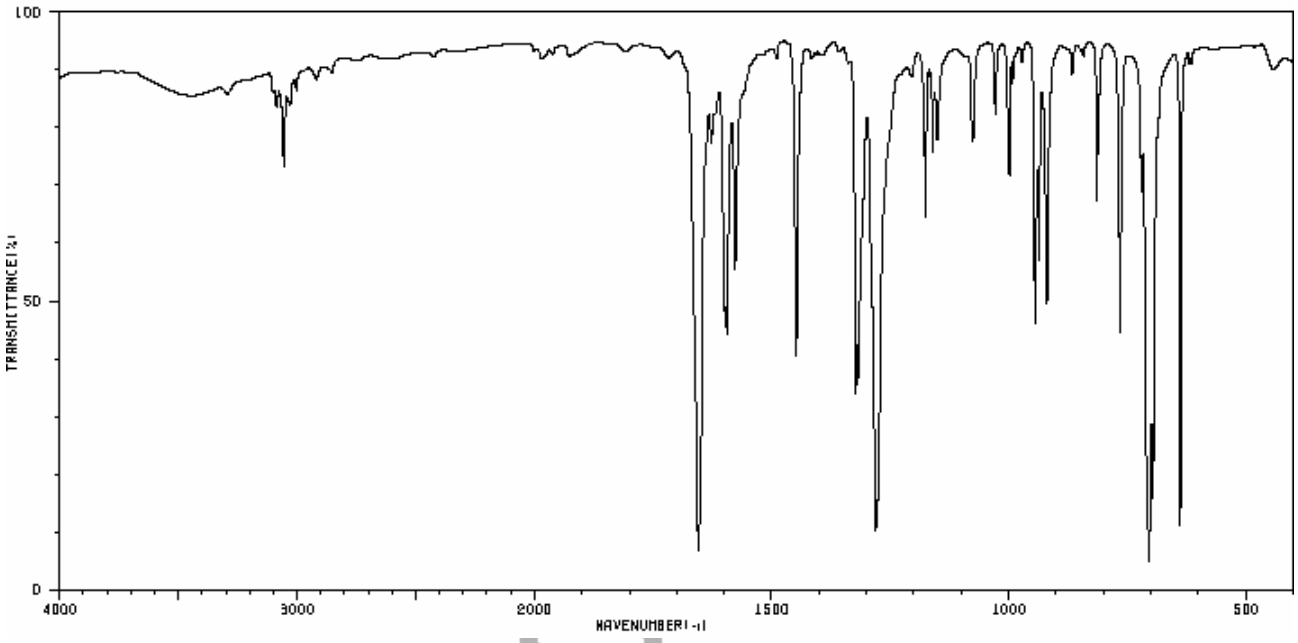
.....

..... **[4]**

(v) The ionic liquid contains the PF_6^- ion. Draw a '*dot-and-cross*' diagram for this ion and give a word that describes its shape.

shape ..... **[3]**

(f) A chemist wished to confirm the identity of a sample of benzophenone by recording its infrared and proton NMR spectra. The infrared spectrum is shown below.

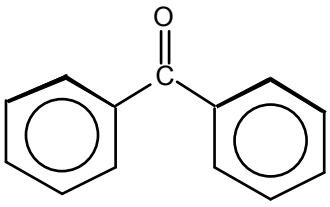


(i) Use the *Data Sheet* to select one absorption in the spectrum that is characteristic of benzophenone. Label this absorption with the bond that causes it. **[1]**

(ii) The proton NMR spectrum of benzophenone contains three signals in the ratio

2 : 2 : 1.

Mark on the structure below all the protons in each environment, lettering the environments **a**, **b** and **c**.



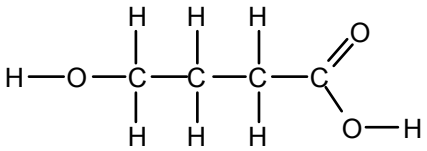
benzophenone

[2]

[Total: 29]

[Turn over

4 The substance GHB was originally designed for use in sleeping pills. However, other drug-abuse issues were identified with the substance and its sale was restricted in 2003. GHB stands for hydroxybutyric acid, an old name for the structure shown below.



GHB

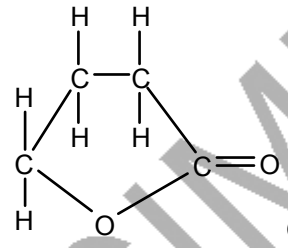
(a) **(i)** Name the **two** functional groups in GHB.

..... **[2]**

(ii) Give the systematic name for GHB.

..... **[2]**

(b) A substance known as GBL is converted into GHB in the body. The structure of GBL is shown below.



GBL

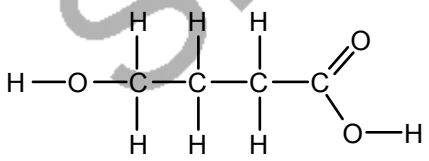
(i) Name the functional group in GBL.

..... **[1]**

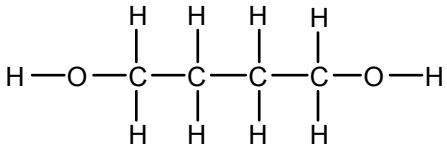
(ii) Name the **type** of reaction by which GBL forms GHB in the body.

..... **[1]**

(c) A molecule that has the same effect on the body as GHB is called 'GHB alcohol'. Its structure is shown below, together with the structure of GHB.



GHB



GHB alcohol

(i) On the molecule of **GHB** above, draw a ring round the largest part of the molecule that could be the *pharmacophore*.

[1]

(ii) Suggest why both of these molecules are able to bind to the same receptor site in the body. Name the intermolecular bonds involved.

.....

.....

..... **[3]**

(d) Chemists are constantly seeking new medicines, starting from known pharmacophores.

(i) Name a modern technique that allows chemists to view the possible ways in which a molecule can bind on to a receptor site.

..... **[1]**

(ii) Suggest how chemists might justify continuing to manufacture GHB when it has been implicated as a 'date-rape' drug.

.....

.....

.....

..... **[2]**

Question 4 continues on the next page.

(e) GHB is a weak acid. Weak acids can be represented as HA.

(i) Write an equation to show how a weak acid HA behaves when dissolved in water.

[1]

(ii) Use ions and molecules from this equation to explain the meaning of the term *conjugate base*.

.....

.....

..... **[2]**

(iii) Write an expression for the acidity constant K_a of an acid HA.

[1]

(iv) A 0.10 mol dm^{-3} solution of GHB has a pH of 2.9.

Calculate the value of K_a for GHB and give its units.

K_a = ... units ..... . **[4]**

(v) State one simplifying assumption that you made when carrying out your calculation in **(iii)**.

.....

..... **[1]**

(f) A mixture of GHB and its sodium salt acts as a buffer solution.

(i) Explain the meaning of the term *buffer solution* and explain why buffer solutions are found in our bodies.

.....

.....

.....

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.....

.....

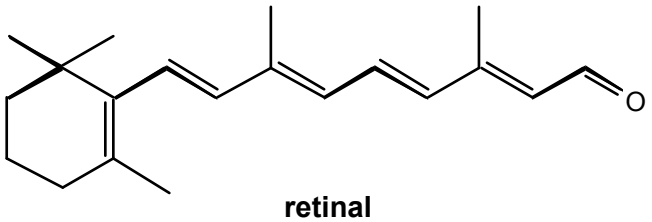
..... **[5]**

(ii) Calculate the pH of a buffer solution containing equal amounts of GHB and its sodium salt.

pH = ... **[2]**

[Total: 29]

5 The rod cells in the retina at the back of the eye contain an alcohol called retinol which is responsible for their sensitivity to light. Retin**ol** is oxidised by an enzyme-catalysed reaction to the aldehyde retin**al**.

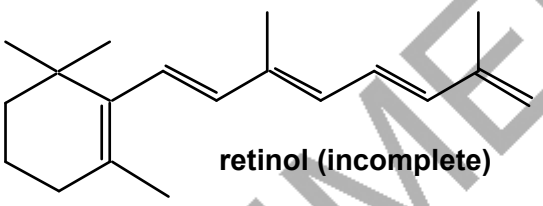


retinal

(a) (i) Deduce the molecular formula of **retinal** from its skeletal formula above.

..... **[1]**

(ii) Suggest the structure of the alcohol **retinol** by completing the skeletal formula below.



retinol (incomplete)

[2]

(iii) Name a functional group which is present in **both** retinol and retinal.

..... **[1]**

(b) (i) What reagents and conditions could be used to convert an alcohol to an aldehyde **in a laboratory**?

.....

.....

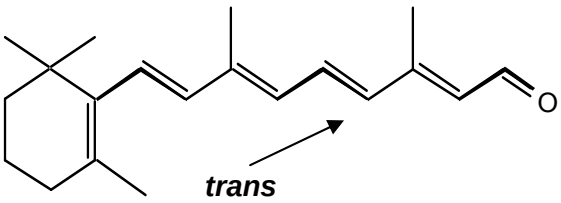
..... **[3]**

(ii) How many moles of hydrogen molecules would you expect to react with one mole of **retinol**?

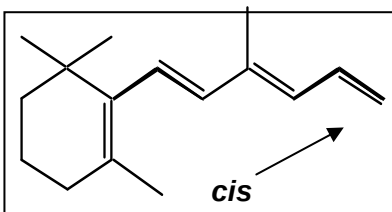
..... **[1]**

(c) When light shines on the rod cells, an enzyme-catalysed reaction occurs. This changes the arrangement around the double bond from *trans* to *cis*, as indicated in the structure below.

(i) Suggest the structure of *cis*-retinal by completing the skeletal formula below.



retinal



***cis*-retinal (incomplete)**

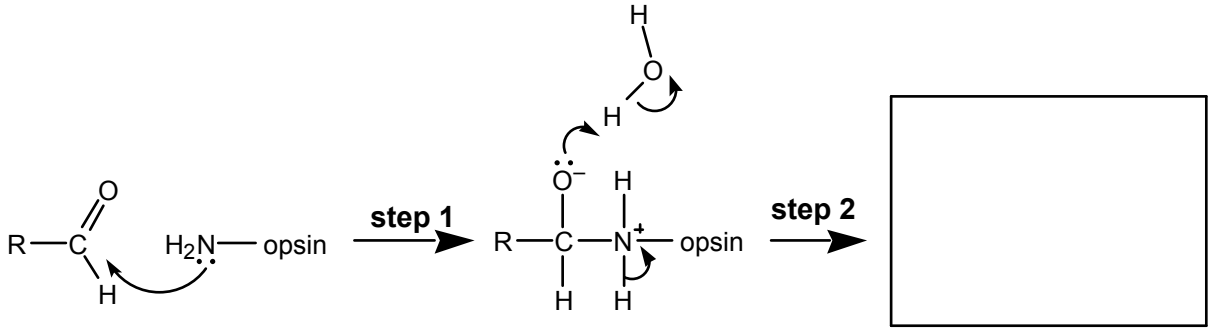
[2]

(ii) Why are the *cis* and *trans* isomers of a compound not identical?

.....

..... **[1]**

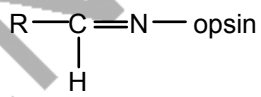
(d) The *cis*-retinal binds to the protein **opsin** to form **rhodopsin**. Part of the mechanism of this reaction is shown below.



***cis*–retinal**

compound X

step 3
elimination of water



rhodopsin

(i) Name the functional group on opsin which is reacting with the aldehyde group on *cis*-retinal.

..... **[1]**

(ii) Name the **type of reaction mechanism** which starts in **step 1** and is completed in **step 2**.

..... **[2]**

(iii) Draw a 'curly arrow' on the *cis*-retinal molecule to complete the electron movements that occur in **step 1**.

[1]

(iv) Deduce a structure for **compound X** and draw it in the box above.

[1]

[Total: 16]

Paper Total [120]

END OF QUESTION PAPER

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

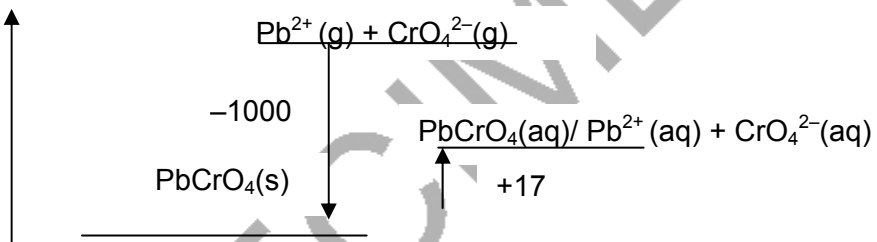
CHEMISTRY B (SALTERS) F335 MS

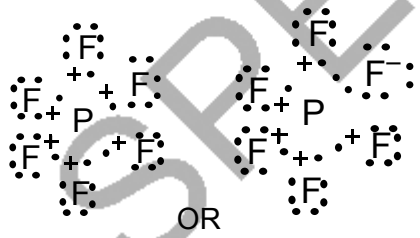
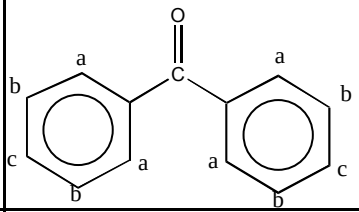
Unit F335: *Chemistry by Design*

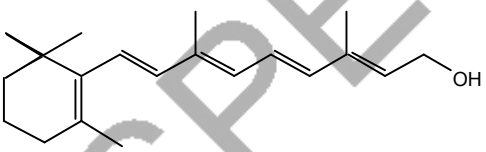
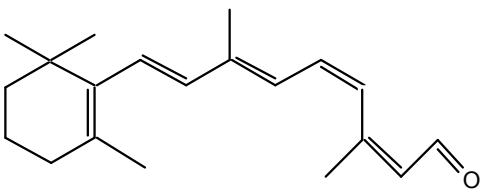
Specimen Mark Scheme

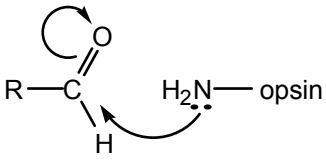
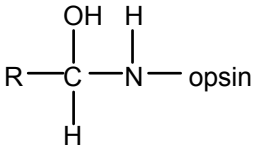
The maximum mark for this paper is **120**.

Question Number	Answer	Max Mark
1(a)(i)	Air allow atmosphere	[1]
(ii)	M_r NH_4NO_3 = 80(.0) (1); % = 28 x 100/80 = 35(.0) % (1)	[2]
(iii)	$(NH_4)_2SO_4$	[1]
(iv)	Advantage: provide nutrients/ return nitrogen to soil/ make plants grow (1); Disadvantage: washed away/ eutrophication (AW)/ waste of resources	[2]
(b)(i)	$[H_2]3$ x $[CO]$/ $[H_2O]$ x $[CH_4]$ (2) award (1) if one error (except addition, scores zero)	[2]
(ii)	292 x 5 x 5/1728 = 4.22 (2) ecf from 1bi (unless addition); award (1) if one error; 3sf scores (1) independently, provided some correct calculation shown.	[3]
(c)(i)	higher yield (1); more molecules on right than left (1); equilibrium position moves in direction of higher pressure (AW) (1) NB firming up on equilibrium position	[3]
(ii)	(compromise) with rate (of setting up equilibrium)	[1]
(d)(i)	$CO + H_2O \rightarrow CO_2 + H_2$	[1]
(ii)	two from: toxic gas; can be burnt as a fuel; produces more hydrogen	[2]
(e)(i)	positive because more (gas) molecules on right (1)	[1]
(ii)	393 + 198 – 189 – 186 = +216 (1) for products – reactants; (1) for 3 x 131; (1) for sign with ecf from a calculation shown	[3]
(iii)	–1784 = +216 – $\Delta H/T$, thus ΔH = +1 x 10^6 (J mol^{-1})(1) ΔS = +216 – ΔH *value*/1000 = –784 J K^{-1} mol^{-1}(1)	[2]
	Total	[24]

Question Number	Answer	Max Mark
2(a)	(6) is the oxidation state/number of the <u>chromium</u>	**[1]**
(b)	$Pb^{2+}(aq) + CrO_4^{2-}(aq) \rightarrow PbCrO_4(s)$ (1) for correct equation (1) for correct state symbols *provided equation shows ions forming compound* or *correct full equation for lead nitrate and sodium chromate.*	**[2]**
(c)	C (1); it reflects in the yellow/ yellow light is in centre of spectrum/ around 600 nm (1)	**[2]**
(d)(i)	3d	**[1]**
(ii)	the (presence of the) ligands (at different orientations to the orbitals)	**[1]**
(e)(i)	iron(III) oxide *ignore gaps*	**[1]**
(ii)	diagram with minimum three levels, getting closer at higher energy (1); *allow from diagram or written account:* levels are electron energy levels (1); electron falling emits light (1); *only award if in terms of energy levels* frequency depends on <u>gap</u> between energy levels/ (Δ)$E = hv$ (1)	**[4]**
(iii)	Cd (1); cadmium(II) sulfide (1); *allow cadmium sulfide*	**[2]**
(f)(i)	 solution enthalpy above solid and correctly labelled (1); top line in place and correctly labelled (1); numbers in correct places (1)	**[3]**
(ii)	–983 (1) *sign essential*	**[1]**
(iii)	broken: ionic (bonds) in lattice (1); hydrogen bonds in water (1); made: ion-dipole bonds (1); QWC - *do not award mark for first spelling error in bond description* bonds broken stronger than bonds made (AW) (1)	**[4]**
	Total	**[22]**
3(a)(i)	–C=O | Cl	**[1]**
(ii)	electrophilic (1); substitution (1) *mark separately*	**[2]**
(b)	shape: regular hexagon/ flat/ all bonds equal length (1); properties: no/few addition reactions/ substitution reactions (1)	**[2]**

Question Number	Answer	Max Mark
(c)	<u>electrons</u> are excited/ move to higher energy levels (1); freqency absorbed depends on energy level <u>gap</u>/ (∆)E = hv (1) frequency/ energy of uv > visible (1); to be coloured must absorb in visible (1) ✎ QWC mark and one from: needs more delocalisation to absorb in visible (AW) (1) transmits/reflects complementary colour	**[5]**
(d)	two marks for any correct pair (*mark for pollutant can be scored alone but NOT effect*) aluminium (compounds); forms toxic waste; HCl; toxic aluminium (compounds); wasted benzene; toxic/ carcinogenic	**[4]**
(e)(i)	an ionic substance that has a low enough melting point to be a liquid at room temperature	**[1]**
(ii)	M_r values C_6H_6 = 78, benzophenone = 182 (1); mass = 182 x 10/78 = 23/23.3 kg (1)	**[2]**
(iii)	FW of all atoms utilised/FW of all atoms used (1) *stated or implied* % atom economy = 182 x 100/(140.5 + 78) = 83(.3) % (1)	**[2]**
(iv)	catalyst/solvent recycled (1); no disposal of toxic products as with $AlCl_3$ (1) high atom economy (1); high percentage yield (1)	**[4]**
(v)	 OR 16 electrons round P (1); rest correct (1) octahedral(1) *ignore – sign*	**[3]**
(f)(i)	C=O at 1650/ C–H at 3000 (1)	**[1]**
(ii)	 all ten protons labelled in some way (1) correct letters (a,b,c in any order) (1) *score (1) if on one ring only*	**[2]**
4(a)(i)	alcohol/ hydroxy(l); carboxylic acid	**[2]**
(ii)	4-hydroxy (1); butanoic acid (1)	**[2]**
(b)(i)	ester /lactone	**[1]**
(ii)	hydrolysis	**[1]**
(c)(i)	circle round all except =O	**[1]**

Question Number	Answer	Max Mark
(ii)	–OH groups (1); hydrogen bond (1); indication that both molecules have same shape/ fit receptor site (1)	**[3]**
(d)(i)	computer modelling	**[1]**
(ii)	*two from:* no suitable alternatives; good sleeping pill – with reason, eg few side-effects; more stringent controls on release of GHB; beneficial uses outweigh problems (1)	**[2]**
(e)(i)	HA $\rightleftharpoons$ H^+ + A^- (*allow reaction with water to produce* H_3O^+)	**[1]**
(ii)	A^- is the conjugate base of HA (1); related by loss of proton (1)	**[2]**
(iii)	$[H^+] \times [A^-]/ [HA]$	**[1]**
(iv)	$[H^+] = 1.26 \times 10^{-3}$ mol dm^{-3} *stated or implied, units not essential* (1); $[A^-] = [H^+]$ stated or implied (1); $K_a = (1.26 \times 10^{-3})^2/10^{-1} = 1.59/1.58/1.6 \times 10^{-5}$ (1) mol dm^{-3} (1) *mark separately*	**[4]**
(v)	[HA] initial = [HA] at equilibrium (AW)/ $[A^-] = [H^+]$	**[1]**
(f)	minimises/resists change in (allow maintains) pH/ pH stays approximately constant(1) when <u>small amounts</u> (1); of <u>acid or alkali</u> added (1); need to maintain pH in body (1); e.g. for enzyme reactions/ blood (1)	**[5]**
(ii)	$[H^+] = K_a$ *stated or implied* (1); pH = –log (1.59×10^{-5}) = 4.8 *ignore sf* (1);	**[2]**
5(a)(i)	$C_{20}H_{28}O$ (1)	**[1]**
(ii)	 –OH (1) correct arrangements of bonds (1)	**[2]**
(ii)	alkene	**[1]**
(b)(i)	acidified/named acid/H^+ (1); (potassium/sodium) dicromate/ $Cr_2O_7^{2-}$ (1); <u>distil</u> (1)	**[3]**
(ii)	5	**[1]**
(c)(i)	 idea of *cis* (1); correct arrangement of bonds (1)	**[2]**
(ii)	lack of free rotation in C=C bonds	**[1]**
(d)(i)	amine	**[1]**
(ii)	nucleophilic (1); addition (1)	**[2]**

Question Number	Answer	Max Mark
(iii)		[1]
(iv)		[1]
	Total	**[16]**
	Paper Total	**[120]**

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)(i)		1		1
1(a)(ii)		2		2
1(a)(iii)	1			1
1(a)(iv)		2		2
1(b)(i)		2		2
1(b)(ii)			3	3
1(c)(i)		3		3
1(c)(ii)		1		1
1(d)(i)		1		1
1(d)(ii)		2		2
1(e)(i)		1		1
1(e)(ii)		3		3
2(a)		1		1
2(b)		2		2
2(c)			2	2
2(d)(i)	1			1
2(d)(ii)	1			1
2(e)(i)	1			1
2(e)(ii)		4		4
2(e)(iii)			2	2
2(f)(i)		3		3
2(f)(ii)		1		1
2(f)(iii)	4			4
3(a)(i)	1			1
3(a)(ii)	2			2
3(b)	2			2
3(c)	5			5
3(d)		4		4
3(e)(i)	1			1
3(e)(ii)		2		2
3(e)(iii)		2		2
3(e)(iv)		4		4
3(e)(v)		3		3
3(f)(i)			1	1
3(f)(ii)		2		2
3(f)(iii)		2		2
4(a)(i)	2			2
4(a)(ii)		2		2
4(b)(i)	1			1

4(b)(ii)		1		**1**
4(c)(i)		1		**1**
4(c)(ii)		3		**3**
4(d)(i)	1			**1**
4(d)(ii)		2		**2**
4(e)(i)	1			**1**
4(e)(ii)	2			**2**
4(e)(iii)	1			**1**
4(e)(iv)		4		**4**
4(e)(v)			1	**1**
4(f)(i)		5		**5**
4(f)(ii)		2		**2**
5(a)(i)		1		**1**
5(a)(ii)		2		**2**
5(a)(iii)	1			**1**
5(b)(i)			3	**3**
5(b)(ii)		1		**1**
5(c)(i)		2		**2**
5(c)(ii)	1			**1**
5(d)(i)	1			**1**
5(d)(ii)		2		**2**
5(d)(iii)		1		**1**
5(d)(iv)		1		**1**
Totals	**30**	**78**	**12**	**120**