Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	2	5	2	/	0	1	Signature	

Paper Reference(s)

6252/01

Edexcel GCE

Chemistry (Nuffield)

Advanced Subsidiary

Unit Test 2

Time: 1 hour 30 minutes

Materials required for examination
Nil

Items included with question papers
Summary passage for Section B

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Answer **ALL** questions in Section A and Section B in the spaces provided in this question paper.
The passage for Section B is provided on a separate sheet.
Calculators may be used.
Final answers to calculations should be given to an appropriate number of significant figures.

Information for Candidates

A Periodic Table is printed on the back cover of this paper.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 5 questions in this question paper. The total mark for this paper is 60.
There are 16 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You are advised to show all steps in any calculations.
You should aim to spend no more than 55 minutes on Section A and 35 minutes on Section B.
You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.
Up to 2 marks will be awarded for the Quality of Written Communication used in Section B.

Printer's Log. No.
NXXX28A
W850/R6252/57570 2/2/2

N X X X 2 8 A 0 1 1 6

Turn over

edexcel

Leave blank

Answer ALL questions in the spaces provided.

Section A

You should aim to spend no more than 55 minutes on this section.

1. Iodine is obtained from three sources: sea water, seaweed and nitrate ores.

(a) (i) Sea water containing iodide ions is concentrated, and then chlorine gas is bubbled through the solution.

Write the balanced **ionic** equation, including state symbols, for the reaction between chlorine gas and iodide ions.

(2)

(ii) What is the final colour of the solution at the end of this reaction?

.....

(1)

(b) In nitrate ores, iodine occurs in the form of iodate ions, IO_3^-.

The first step of the process to extract iodine involves reaction of iodate ions with sulphur dioxide gas to form iodide ions and sulphate ions, SO_4^{2-}.

(i) State the oxidation number of iodine in

iodide ions, I^- .....

iodate ions, IO_3^- .....

(1)

(ii) State the oxidation number of sulphur in

sulphur dioxide, SO_2 .....

sulphate ions, SO_4^{2-} .....

(1)

(iii) Balance the ionic equation for the reaction between iodate ions and sulphur dioxide gas to produce iodide ions and sulphate ions.

$IO_3^-(aq) + ...SO_2(g) + ...H_2O(l) \rightarrow I^-(aq) + ...SO_4^{2-}(aq) + ...H^+(aq)$

(2)

Leave blank

(c) (i) The next step is to add a small quantity of a solution containing iodate ions. These react with the iodide ions present to form an iodine solution.

Iodine can be extracted from this solution by the addition of a hydrocarbon solvent and separation of the hydrocarbon solution using a separating funnel.

Draw a diagram of a separating funnel and its contents. Indicate which is the hydrocarbon layer and state its colour. [Density of the hydrocarbon is 0.660 g cm^{-3}]

Colour of hydrocarbon layer .....

(3)

(ii) How might solid iodine be obtained from the hydrocarbon layer?

.....

(1)

(Total 11 marks)

Q1

Leave blank

2. The industrial processes involved in the production of poly(chloroethene) are summarised in the flow chart:

ethane → ethene → 1,2-dichloroethane → chloroethene → poly(chloroethene)

(a) (i) Ethane is converted to ethene by dehydrogenation.

Write a balanced equation, including state symbols, for this equilibrium reaction.

(1)

(ii) Explain why conditions of high pressure are less favourable for ethene production.

.....

.....

.....

.....

(2)

(b) Draw a labelled diagram of an ethene molecule, showing the electron density distribution in the σ and π bonds between the carbon atoms.

(2)

(c) Give a chemical test which would distinguish between ethane and ethene.

State the result of your test with ethene.

Test .....

Result .....

(2)

(d) 1,2-dichloroethane is formed from ethene by reaction with chlorine.

State the type and mechanism of this reaction.

Type .....

Mechanism .....

(2)

Leave blank

(e) (i) Suggest a reagent and TWO conditions for making chloroethene from 1,2-dichloroethane in the laboratory.

Reagent .....

Conditions .....

(2)

(ii) Name **both** types of intermolecular force between chloroethene molecules.

.....

.....

(1)

(f) (i) Write a balanced equation for the formation of poly(chloroethene) from chloroethene.

(2)

(ii) Poly(chloroethene) is also known by the name polyvinylchloride, PVC.

Give TWO common uses of poly(chloroethene).

.....

.....

(2)

Q2

(Total 16 marks)

Leave blank

3. Phosphine, PH_3, is a hydride of the Group 5 element, phosphorus.

(a) (i) Draw a 'dot-and-cross' diagram of a phosphine molecule. You should include only outer shell electrons.

(1)

(ii) Draw the shape you would expect for the phosphine molecule, suggesting a value for the HPH bond angle.

HPH bond angle .....

(2)

(iii) Explain the shape of the phosphine molecule you have given in your answer in (ii).

Justify your value for the HPH bond angle.

.....

.....

.....

.....

(2)

Leave blank

(b) (i) Write a balanced equation, including state symbols, for the atomisation of phosphine gas.

.....

(1)

(ii) Use your answer to (i) and the data below to calculate the standard enthalpy change of atomisation of phosphine at 298 K. Include a sign and units in your answer.

$\Delta H_f^{\ominus}$ [$PH_3(g)$] = + 5.4 kJ mol^{-1}

$\Delta H_{at}^{\ominus}$ [$\frac{1}{2}H_2(g)$] = +218.0 kJ mol^{-1}

$\Delta H_{at}^{\ominus}$ [P(s)] = +314.6 kJ mol^{-1}

(3)

(iii) Calculate a value for the bond energy of the bond between phosphorus and hydrogen, using your answer to (ii).

(1)

(Total 10 marks)

Q3

Leave blank

4. This question is about phosphine, PH_3, and ammonia, NH_3.

(a) Which compound has the stronger van der Waals forces?

Justify your answer.

.....

.....

(1)

(b) (i) The boiling points of ammonia and phosphine are:

Ammonia	240 K
Phosphine	185 K

Name the intermolecular force responsible for the higher boiling point of ammonia.

.....

(1)

(ii) Use **displayed** formulae to show this intermolecular bond between two ammonia molecules.

Clearly mark and label the bond angle **between** the molecules.

(2)

Leave blank

(c) Indicate the solubilities of silver chloride, silver bromide and silver iodide in dilute and concentrated ammonia solution by completing the table. Write the word **soluble** or **insoluble** as appropriate.

	Silver chloride	Silver bromide	Silver iodide
Dilute ammonia solution			
Concentrated ammonia solution			

(2)

(d) Ammonia can also be used to test for hydrogen chloride gas.

(i) What would you **see** if a glass rod, dipped in ammonia solution, is placed in hydrogen chloride gas?

.....

(1)

(ii) Write a balanced equation for this reaction.

(1)

Q4

(Total 8 marks)

TOTAL FOR SECTION A: 45 MARKS

Paper Reference(s)

6252/01

Edexcel GCE

Chemistry (Nuffield)

Advanced Subsidiary

Unit Test 2: Passage for Section B

Printer's Log. No.

NXXX28A

Turn over

W850/R6252/57570 2/2/2

edexcel

THE DANGERS OF EXPOSURE TO THE SUN AND HOW TO AVOID THEM

During the latter part of the twentieth century a suntan became associated with fitness, youth and health. Increasing leisure time and cheap travel have helped certain populations to increase their lifetime ultraviolet radiation (UVR) exposure way beyond previous generations. Unfortunately this level of UVR exposure has increased the risk of damage to the skin caused by sunlight, called cutaneous photodamage. This photodamage has two potentially undesirable effects – premature ageing of the skin, called photoaging, and skin cancer.

When skin is exposed to ultraviolet radiation a proportion of the energy of the radiation is absorbed. Initially electrons in molecules in the skin are promoted to higher energy levels, producing electronically excited molecules. These electronically excited molecules may react in several ways. They might simply break up heterolytically to produce fragment ions which react to produce toxic photoproducts. They may form highly reactive free radicals, or powerful oxidising agents by reaction with oxygen, which damage cells or other biologically important molecules. Finally, they may directly interact with cells in a damaging way.

There are three ways of reducing the risk from UVR exposure. These are directly limiting sun exposure by avoiding going out in the sun, the use of appropriate clothing and the careful use of sunscreen products.

Directly limiting sun exposure is effective. However, it is socially unacceptable and, with a desirable increase in outdoor activities like jogging, it is impractical.

Clothing which is made of opaque fabric is effective. It is important that the fabric is not flimsy or 'see-through'. It should also be noted that many fabrics lose as much as 70% of their sun protection factor when wet. Broad-brimmed hats can reduce head and neck exposure significantly, but will still allow about 30% of damaging radiation exposure from reflected light, particularly when near sand or water.

There are two main types of sunscreen preparations, those that reflect the sun's rays, and those that filter out the harmful UVR.

Historically, the first reflective preparation was issued to soldiers during the Second World War. Known as 'Red Vet Pet', it was a suspension of iron(III) oxide in petroleum jelly. It was extremely effective but was thick, greasy and gave a bizarre appearance. Nowadays similar effective preparations, which reflect harmful UVR, use zinc oxide or titanium dioxide. The only problem with these is one of cosmetic acceptability. As well as reflecting UVR, they tend to reflect visible light giving the user the appearance of a circus clown. Recently this problem has been overcome by using a very fine particle size of titanium dioxide which limits the reflection of visible wavelengths. This type of sunscreen has the major advantage of reflecting all wavelengths of ultraviolet radiation.

A wide variety of chemicals are used in filter preparations. These include esters of 4-aminobenzoic acid, esters of cinnamic acid, benzophenones, salicylates, and anthranilates. These usually act by absorbing harmful ultraviolet radiations. The disadvantage is that these chemicals only absorb over a small range of ultraviolet frequencies, so some harmful radiations will still reach the skin. The key is to check on the package of sunscreen that it is effective against both UVA and UVB, the two ranges of UVR frequencies which are known to be harmful.

(533 words)

(Source: Adapted from 'The benefits of lifetime photoprotection' by J Gray and J L M Hawk published by the Royal Society of Medicine Press, and 'Sun damaged skin' by Ronald Marks published by Dunitz.)

Leave blank

SECTION B

You should aim to spend no more than 35 minutes on this section. The passage needed for this section is provided on a separate sheet.

5. Read the passage on **THE DANGERS OF EXPOSURE TO THE SUN AND HOW TO AVOID THEM** straight through, and then read it again more carefully, in order to answer the following questions.

(a) What are the TWO reasons for increased exposure to the sun nowadays?

.....

.....

.....

(1)

(b) What are the TWO undesirable effects of exposure to ultraviolet radiation?

.....

.....

.....

.....

(2)

(c) What is meant by the following terms:

(i) heterolytically

.....

.....

(ii) free radical

.....

.....

(iii) oxidising agent?

.....

.....

(3)

Leave blank

(d) Write a summary, in no more than 100 words, describing the methods for avoiding exposure to ultraviolet radiation and how effective they are.

(9)

You are NOT asked to summarise the whole passage, or to include equations in your summary.

At the end of your summary state the number of words you have used.

Credit will be given for answers written in good English, using complete sentences and using technical words correctly and chemical names rather than formulae. Avoid copying long sections from the original text. Numbers count as one word, as do standard abbreviations, units and hyphenated words. Any title you give your passage does not count in your word total.

There are penalties for the use of words in excess of 100.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Leave blank

Q5

(Total 15 marks)

TOTAL FOR SECTION B: 15 MARKS

TOTAL FOR PAPER: 60 MARKS

END

BLANK PAGE

BLANK PAGE

BLANK PAGE

THE PERIODIC TABLE

Period	1	2	Group										3	4	5	6	7	0
1	1 H Hydrogen 1																	2 He Helium 4
2	3 Li Lithium 7	4 Be Beryllium 9											5 B Boron 11	6 C Carbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
3	11 Na Sodium 23	12 Mg Magnesium 24											13 Al Aluminium 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulphur 32	17 Cl Chlorine 35.5	18 Ar Argon 40
4	19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 63.5	30 Zn Zinc 65.4	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
5	37 Rb Rubidium 85	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium (99)	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131
6	55 Cs Caesium 133	56 Ba Barium 137	57 ► La Lanthanum 139	72 Hf Hafnium 178	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201	81 Tl Thallium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium (210)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radius (226)	89 ►► Ac Actinium (227)	104 Unq Unnil-quadium (261)	105 Unp Unnil-pentium (262)	106 Unh Unnil-hexium (263)												

Key

Atomic Number
Symbol
Name
Molar mass in g mol^{-1}

► Lanthanide elements	58 Ce Cerium 140	59 Pr Praseo-dymium 141	60 Nd Neodymium 144	61 Pm Promethium (147)	62 Sm Samarium 150	63 Eu Europium 152	64 Gd Gadolinium 157	65 Tb Terbium 159	66 Dy Dysprosium 163	67 Ho Holmium 165	68 Er Erbium 167	69 Tm Thulium 169	70 Yb Ytterbium 173	71 Lu Lutetium 175
►► Actinide elements	90 Th Thorium 232	91 Pa Protactinium (231)	92 U Uranium 238	93 Np Neptunium (237)	94 Pu Plutonium (242)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (245)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (253)	101 Md Mendelevium (256)	102 No Nobelium (254)	103 Lr Lawrencium (257)