OCR
RECOGNISING ACHIEVEMENT

GCSE

CHEMISTRY B

H

B642/02

Chemistry B Unit 2: Modules C4, C5, C6

Specimen Paper

60 mins

Candidates answer on the question paper:

Additional materials: ruler (cm/mm), calculator

Candidate Name	

Centre Number						Candidate Number				

TIME 60 mins

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers on the dotted lines unless the question says otherwise.
- 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.
- There is a space after most questions. Use it to do your working. In many questions marks will be given for a correct method even if the answer is incorrect.
- Do not write in the bar code. Do not write in the grey area between the pages.
- DO NOT WRITE IN THE AREA OUTSIDE THE BOX BORDERING EACH PAGE. ANY WRITING IN THIS AREA WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60.**

This specimen paper consists of 29 printed pages.

Registered Charity Number: 1066969

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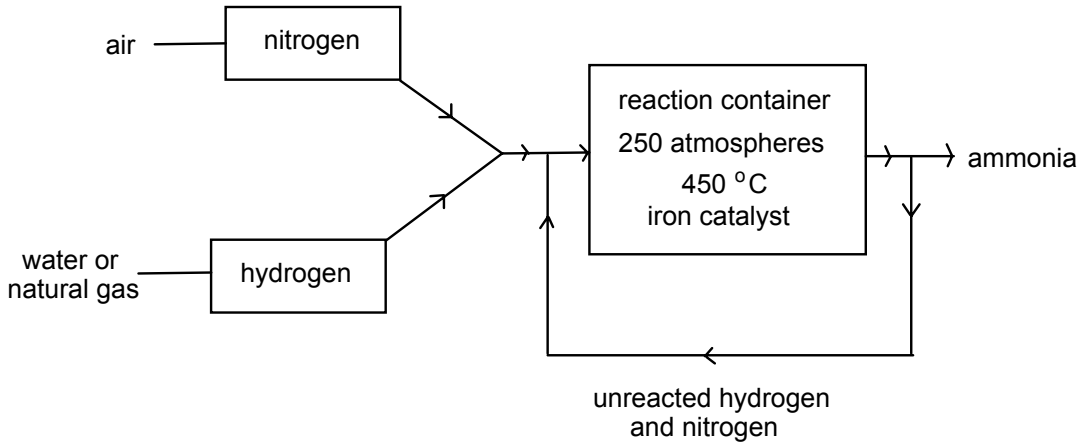
Answer all questions.

1. Ammonia is made from nitrogen and hydrogen.

Look at the flow chart. It shows how ammonia is made using the Haber process.



(a) Nitrogen and hydrogen react together to make ammonia in the converter.

(i) The use of the catalyst reduces the cost of making ammonia.

Explain how.

.....

.....[1]

(ii) Not all the hydrogen and nitrogen react in the converter.

Unreacted nitrogen and hydrogen are recycled.

Suggest one advantage of this.

.....

.....[1]

(b) The reaction between nitrogen and hydrogen is reversible.

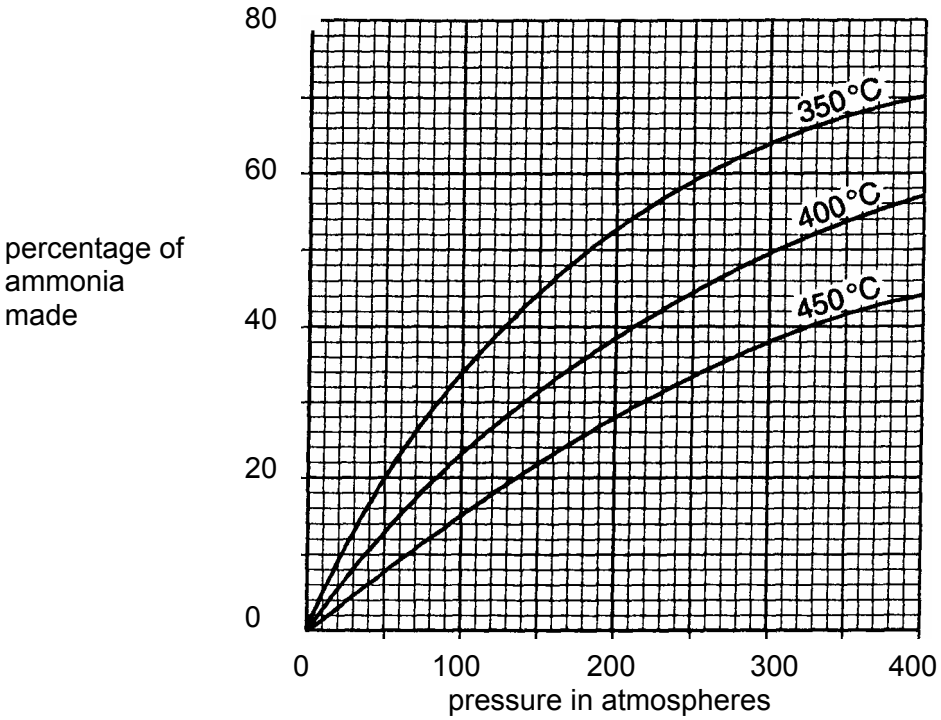
Explain what this means.

.....

.....[1]

(c) Look at the graphs.

They show the percentage of ammonia made in the converter at different temperatures and pressures.



(i) Look at the graph for 350 °C.

The percentage of ammonia changes as the pressure increases.

Describe how.

.....[1]

(ii) Look at the graphs.

The percentage of ammonia changes as the temperature increases.

Describe how.

.....[1]

(iii) Look at the graphs.

Write down a temperature and a pressure which make 20% of ammonia.

Temperature .....°C

Pressure.....atmospheres [1]

[Total: 6]

2. Ammonium sulphate is a fertiliser.

(a) Ammonium sulphate dissolves in water.

Explain why it is important for fertiliser to be soluble in water.

.....

.....[1]

(b) Jas and Andy make some ammonium sulphate.

They mix ammonia solution with dilute sulphuric acid.

Ammonia, NH_3, reacts with sulphuric acid, H_2SO_4, to make ammonium sulphate, $(NH_4)_2SO_4$.

(i) Write down the balanced symbol equation for this reaction.

.....[2]

(ii) They predict that they will make 8.0 g.

They actually make 6.0 g.

Calculate their percentage yield/ (show your working).

.....

.....

.....

Answer ..... % [2]

(iii) The formula for ammonium sulphate is $(NH_4)_2SO_4$.

Calculate the percentage by mass of nitrogen in ammonium sulphate.

The relative atomic mass of H is 1, of N is 14, of O is 16 and S is 32.

.....

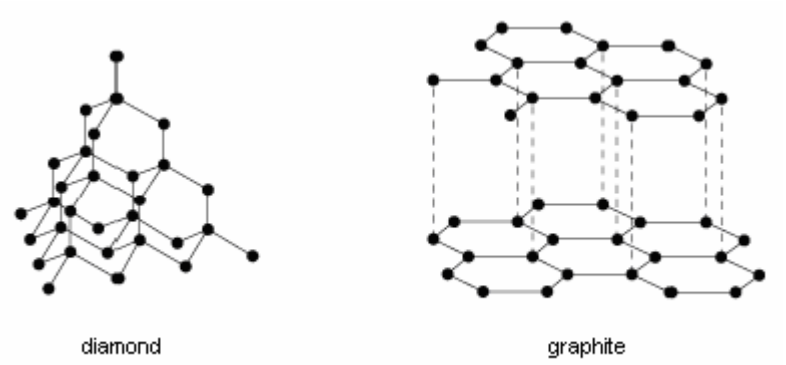
.....

Answer ..... % [3]

[Total: 8]

3. This question is about diamond and graphite.

Look at the diagrams. They show the structure of diamond and graphite.



Diamond and graphite are forms of the same element.

Draw a straight line from each use to the reason why diamond or graphite is suitable for this use.

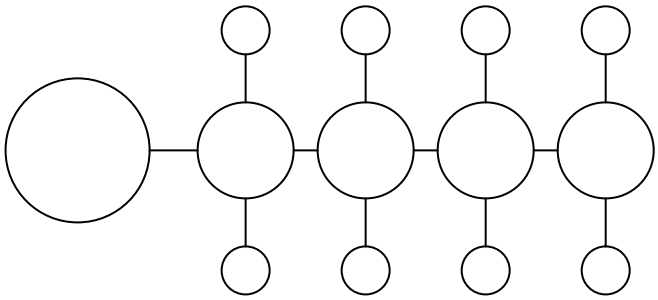
use	reason
Graphite is used in pencil leads	because it conducts electricity
Diamond is used in cutting tools	because it sparkles and is transparent
Graphite is used as an electrode in electrolysis	because it is has a high melting point and is very hard
Diamond is used in jewellery	because it is slippery

[3]

[Total: 3]

4. Washing up liquids contain a detergent.

Look at the diagram. It shows a detergent molecule.



Write about how detergents work.

Your answer should include

- The structure of a detergent molecule
- How detergents remove fat
- The forces between molecules.

You may wish to draw a diagram.

.....

.....

.....

.....[3]

[Total: 3]

Section 2

5. Mary finds that 3.2 g of copper reacts with 0.4g of oxygen.

[Relative atomic mass: O=16, Cu=64]

(a) 0.05 moles of copper are present.

How many moles of oxygen are present?

.....[2]

(b) What is the empirical formula of the copper oxide?

.....

.....[1]

[Total: 3]

6. **(a)** Ali says that when equilibrium is reached the amounts of reactants and products don't change.

He says that this means the reaction has stopped.

Jill says Ali is wrong.

Why is Jill right?

.....

.....

.....

.....

[3]

(b) The following reaction reaches equilibrium

$A + B \rightleftharpoons C + D$

The forward reaction is exothermic.

Predict what will happen to the equilibrium if the temperature is increased.

.....

.....[2]

[Total: 5]

7. Some breakfast cereals are sold in 'single helping' packs.

Arthur looks at the pack to see what it contains.

20gram OCR CEREAL

OCR CEREAL		
Nutritional Information Per 100g		
ENERGY	1574 kj	
PROTEIN	7g	
CARBOHYDRATES	85g	
of which sugars	8g	
starch	77g	
MINERALS		[%RDA*]
IRON	7.9mg	[55]
* Recommended Daily Allowance		

(a) Arthur says that the pack of cereal will give him 55% of the recommended daily allowance of iron. This is NOT true. Explain why.

.....

.....[2]

(b) A large packet of cereal contains 1g of sodium.

Arthur knows that the mass of salt is 2.54 times greater than the mass of sodium.

In fact, the cereal pack contains less than 2.54g of salt.

Suggest why.

.....

.....[1]

[Total: 3]

8. Jane reacted magnesium ribbon with hydrochloric acid.

All the acid was used up, and 48 cm^3 of hydrogen gas was formed.

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

(a) How many moles of hydrogen gas were produced?

I mol of gas occupies 24000cm^3 at room temperature and pressure.

.....

.....[2]

(b) If calcium is used instead of magnesium, the same volume of gas is produced.

$Ca + 2HCl \rightarrow CaCl_2 + H_2$

However, the mass of calcium that reacts is greater than the mass of magnesium that reacted in the last experiment. Explain why.

.....

.....[2]

[Total: 4]

9. **(a)** Potassium chloride is made of ions.

Solid potassium chloride does not conduct electricity.

Melted potassium chloride does conduct electricity.

Why does potassium chloride start to conduct when it is melted?

.....

.....[2]

(b) Arthur electrolyses a solution of potassium chloride.

He expects potassium to form at the cathode, but something else happens.

What happens? Explain your answer.

.....

.....[3]

[Total: 5]

Section 3

10. A car manufacturer is making a car powered by a hydrogen-oxygen fuel cell.

Water is the only substance made in the cell.

(a) The car manufacturer is developing hydrogen-oxygen fuel cells to replace petrol engines

Suggest why.

.....

.....

.....

.....[2]

(b) Write a balanced symbol equation for the overall reaction in the fuel cell.

.....[2]

[Total: 4]

11. Large amounts of ethanol, C_2H_5OH, are available in Western Europe.

In industry, ethene, C_2H_4, is used to make ethanol, C_2H_5OH.

Write about how ethene is made into ethanol.

You should include

- the other materials used
- the conditions used

.....

.....

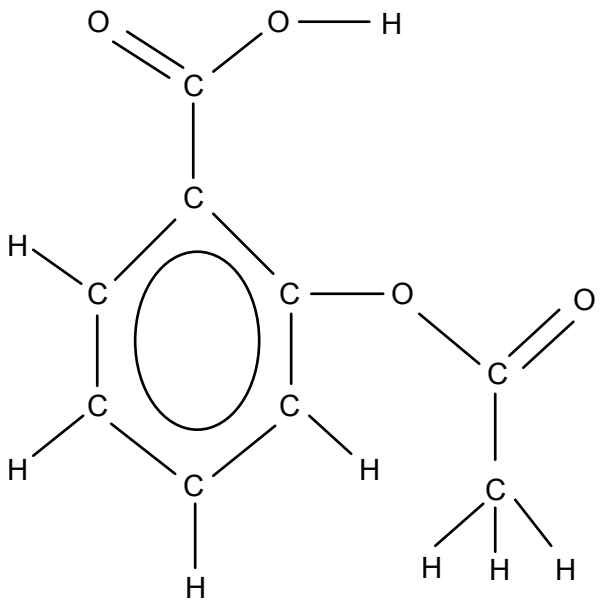
.....

.....[3]

[Total: 3]

12. Aspirin is a very common analgesic drug.

Look at the displayed formula of aspirin.



(a) Write down the molecular formula of aspirin.

.....[1]

(b) Treating aspirin with sodium hydroxide produces soluble aspirin.

(i) Suggest an advantage of using soluble aspirin.

.....

.....[1]

(ii) Soluble aspirin dissolves in water but aspirin does not.

Explain why. Use ideas about structure and bonding in your answer.

.....

.....

.....

.....[2]

[Total: 4]

13. Chlorofluorocarbons, CFCs, break down in the stratosphere to produce chlorine free radicals.

The ozone layer in the stratosphere is depleted by these chlorine free radicals.

Look at these equations.

They show how ozone can be broken down by chlorine free radicals.

$$Cl\bullet + O_3 \rightarrow O_2 + ClO\bullet$$

$$ClO\bullet + O_3 \rightarrow 2O_2 + Cl\bullet$$

(a) One chlorine free radical can break down over 5000 ozone molecules.

Explain how.

.....

.....

.....

.....[2]

(b) Many countries have now banned the use of CFCs

Despite this CFCs will continue to deplete the ozone layer.

Explain why.

.....

.....[1]

[Total: 3]

14. Sam investigates the hardness of different water sample.

He uses distilled water and two other samples labelled **A** and **B**.

He adds soap solution to 100 cm^3 of each sample until a lasting lather is formed.

Sam boils fresh 100 cm^3 samples of distilled water, sample **A** and sample **B.**

He repeats the test with soap solution on the boiled samples.

Look at the table it shows his results.

sample	**volume of soap solution needed to give a lather using**	
	unboiled water in cm^3	**using boiled water in cm^3**
distilled water	1.0	1.0
A	9.5	1.0
B	13.0	7.0

(a) Sample **B** contains equal amounts of temporary and permanent hardness.

How can you tell from the information in the table of results?

.....

.....

.....[1]

(b) Write down the name of the compound decomposed when temporary hardness is removed.

.....[1]

(c) A sample of hard water contains aqueous calcium ions, Ca^{2+}.

Explain how adding sodium carbonate to this sample will remove the hardness.

.....

.....[1]

[Total: 3]

15. Natural fats and oils are very useful in the food industry.

Look at the table about natural fats and oils.

It shows the percentage of saturated and unsaturated fats and oils.

fat or oil	percentage of saturated fat or oil	percentage of unsaturated fat or oil
butter	31	69
olive oil	5	95
palm oil	9	91
whale oil	6	94

(a) Medical research indicates that unsaturated fats are healthier in a diet than saturated fats.

Many people consider a diet containing olive oil is better than one containing whale oil.

Suggest why.

.....

.....[1]

(b) Sarfraz investigates a sample of fat.

Describe how he could use bromine water to tell if the fat was saturated or unsaturated.

.....

.....

.....[2]

[Total: 3]

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The Lanthanides (atomic numbers 58-71) and the Actinides(atomic numbers 90-103) have been omitted.***

Cu and Cl have not been rounded to the nearest whole number.

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CHEMISTRY B

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B642/02

Chemistry B Unit 2: Modules C4, C5, C6

Specimen Mark Scheme

60 mins

Maximum mark for this paper is 60

This specimen mark scheme of 5 printed pages.

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Question Number	Answer	Max Mark
Section 1		
1(a)i	Reduces energy costs because less heat being needed / makes more product in a shorter time / aw;	**[1]**
1(a)ii	Cuts down on waste / no waste of starting materials / aw;	**[1]**
1(b)	Product can change back to reactants / reaction can go both ways / aw;	**[1]**
1(c)i	Increases / goes up / aw	**[1]**
1(c)ii	Decreases / goes down / aw	**[1]**
1(c)iii	350 and 50 atmospheres / 400 and 80 - 90 atmospheres / 450 and 135 – 145 atmospheres	**[1]**
	Total marks	**[6]**
2(a)	So it can be absorbed by the roots / aw **(allow so it can be sprayed easily)**	**[1]**
2(b)i	$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$ **allow** any correct multiple of equation) Correct reactant and products; Balancing;	**[2]**
2(b)ii	Percentage yield = (actual yield ÷ predicted yield) ×100 75% **(allow full marks for correct answer with no working out)**	**[2]**
2(c)	Relative molecular mass = 132 (1) **(allow ecf from wrong Mr)** Fraction of nitrogen = 28/132 (1) **(allow ecf from use of 14 rather than 28)** Percentage = 21.2 (%)	**[3]**
	Total marks	**[8]**
3	Graphite is used in pencil leads because it is slippery; Diamond is used in cutting tools because it has a high melting point and is very hard; Graphite is used as an electrode in electrolysis because it conducts electricity; Diamond is used as jewellery because it sparkles and is transparent All 4 correct (3) 2 or 3 correct (2) 1 correct (1)	**[3]**
	Total marks	**[3]**

4	Any three from: Detergent molecule has a hydrophobic tail and a hydrophilic head **(allow fat loving tail and water loving head)**; Tail forms strong intermolecular forces with fat molecules; Detergent molecules surround the fat droplet; Head forms intermolecular forces with water molecules; **Total marks**	**[3]** **[3]**
Section 2		
5(a)	0.4/16 = 0.025 **(correct working = 1)**	**[2]**
5(b)	Cu_2O (allow error carried forward) **Total marks**	**[1]** **[3]**
6(a)	amounts of reactants/products constant; reaction continues; rates equal;	**[1]** **[1]** **[1]**
6(b)	discusses equilibrium <u>position</u> moves to left **(equilibrium moves to left' = 1)** **Total marks**	**[1]** **[1]** **[5]**
8(a)	48/24000 = 0.002	**[2]**
8(b)	particles / ions of calcium; heavier than those of magnesium (accept 'atoms' of calcium); **Total marks**	**[1]** **[1]** **[4]**
9(a)	ions move; in liquid [only] / during conduction;	**[1]** **[1]**
9(b)	hydrogen formed; from the water; potassium ions too stable / hydrogen ions preferentially discharged; **Total marks**	**[1]** **[1]** **[1]** **[5]**

Section 3		
10(a)	Any two from: Prevents pollution; Reduce CO_2 emissions; Reduce oxides of nitrogen; Preserve petroleum stocks / aw;	**[2]**
10(b)	$2H_2 + O_2 \rightarrow 2H_2O$ **(allow any correct multiple)** Correct reactants and products Correct Balancing **Total marks**	**[2]** **[4]**
11	**Any three from** React with steam / react with water; Using a (phosphoric acid) catalyst; Heated / high temperature / quoted temperature between 100 ^{o} and 300^{o}C; High pressure / quoted pressure 30 – 80 atmospheres; **Total marks**	**[3]** **[3]**
12(a)	$C_9H_8O_4$	**[1]**
12(b)i	It acts faster	**[1]**
12(b)ii	**Any two from** $-COO^-$ ion formed; Ionic compounds dissolve in water; Aspirin is covalent and covalent compounds are not soluble; **Total marks**	**[2]** **[4]**
13(a)	Chlorine free radicals react they form more free radicals / ClO• free radicals **(allow 1 mark for just chain reaction)** These react to reform Cl• which can react again	**[2]**
13(b)	CFCs are inert / CFCs do not react with water / rate of breakdown of CFC in stratosphere is extremely low **(allow not all countries have banned CFCs)** **Total marks**	**[1]** **[3]**

14(a)	Boiling removes exactly half of the hardness / aw	**[1]**
14(b)	Calcium hydrogencarbonate / magnesium hydrogencarbonate	**[1]**
14(c)	Calcium carbonate precipitated / calcium ions react with carbonate ions to give (insoluble) solid / aw	**[1]**
	Total marks	**[3]**
15(a)	Olive oil high in unsaturated fat WTTF	**[1]**
15(b)	Unsaturated fat goes colourless **(Not clear, allow unsaturated fat decolourises bromine)**	**[2]**
	Saturated fat stays orange	**[3]**
	Total marks	**[60]**
	Overall marks	