

GCSE

CHEMISTRY A

Chemistry A Unit 3 Ideas in Context plus C7

Specimen Paper

Candidates answer on the question paper:

Additional materials: ruler (cm/mm), calculator

F

A323/01

1 hour

Candidate
Name

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Centre
Number

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Candidate
Number

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TIME 1 hour

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 **55**.

This specimen paper consists of 24 printed pages.

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Answer all questions.

1. This newspaper article is about a food scare that occurred in February 2005.

Carcinogenic dye causes food scare

More than 400 well-known processed foods have been removed from sale because they are contaminated with an illegal red dye which can cause cancer.

The bright red dye, has been used to colour a batch of chilli powder used as an ingredient in a brand of Worcester sauce. The sauce in turn was sold on to hundreds of food companies for manufacture into famous brands of food and supermarket ready meals.

Some flavours of crisps were removed from supermarket shelves.

This table shows how the crisis developed.

28 January 2005	Sudan 1 contamination of chilli powder is discovered by a laboratory in Italy.
1 February 2005	Sudan 1 is found in a brand of Worcester sauce. Environmental health officers are notified.
7 February 2005	Further tests finally confirm presence of the dye.
10 February 2005	The Food Standards Agency (FSA) demands a list of companies supplied the Worcester Sauce for use in other products.
14 February 2005	The list of 200 companies is received by the FSA. The FSA begins ringing the companies.
15 February 2005	The FSA begins telling the companies and supermarkets that they are planning a recall.
18 February 2005	Britain's largest food recall is launched, with more than 400 products withdrawn from supermarket shelves.

Sudan 1 has been shown to cause liver cancer in animal tests. It has not been shown to cause cancer in humans. Sudan 1 is not permitted as a dye for foods in the EU but is used as a colour for boot polish, industrial solvents and petrol.

“At the levels present the risk is likely to be very small but it is sensible to avoid eating any more. There is no risk of immediate ill-health,” said the chief executive of the FSA.

A further difficulty is that by the time the contaminated chilli has been used in other ingredients such as Worcester sauce it is present only in parts per billion making it virtually undetectable.

(a) Sudan 1 was added to make the chilli powder bright red.

(i) Suggest why the manufacturers wanted the chilli powder to be bright red.

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

(ii) Why was it not a good idea to add Sudan 1 to chilli powder?

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

(iii) Sudan 1 has a variety of uses that are not connected with food.

Describe one of these uses.

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

(b) How long did it take from the discovery of Sudan 1 in a brand of Worcester sauce to the recall of contaminated food from UK supermarkets?

..... days [1]

- (c) Over 400 food products were removed from supermarket shelves.

Describe how the Sudan 1 contamination got into so many food products?



One mark will be for a clear ordered answer.

.....

.....

.....

..... [3+1]

- (d) The chief executive of the FSA says that the risk from eating these foods contaminated with Sudan 1 is very small.

Suggest why the risk is small.

.....

..... [2]

- (e) Scientists test a brand of meat pie for the presence of Sudan 1.

They test samples from two different supermarkets.

Results of their tests are shown in the table.

sample	Sudan 1 content in ppm							range	average
	1	2	3	4	5	6			
supermarket A	16	13	19	15	12	14	12 to 16	14	
supermarket B	12	10	13	14	12	11	————	————	

(i) The scientists test several samples from each supermarket.

Suggest why.

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

(ii) The scientists work out the range and average for the samples from supermarket **A**. They ignore the value for sample 3.

Suggest why.

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

(iii) Work out the range and best estimate for the samples from supermarket **B**.

Range =

toppm

Best estimate =ppm

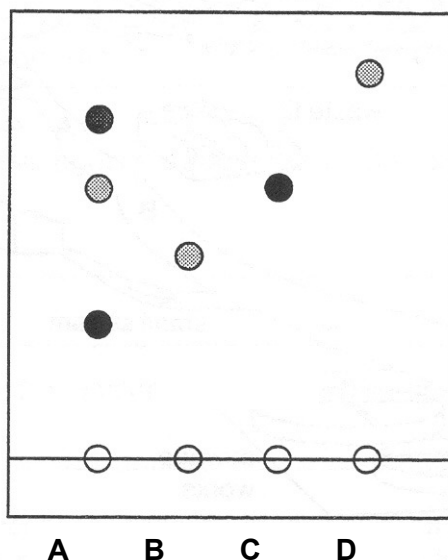
[Total: 6]

2. Scientists test an orange drink to see if it contains a banned colour additive.

This is a description of what the scientists do.

- Step 1 They draw a pencil line 2 cm from the bottom of a piece of absorbent paper.
- Step 2 They place spots of the orange drink and each of three banned colour additives on the pencil line. They use a pencil to label the orange drink spot **A** and the banned colour additive spots **B**, **C** and **D**.
- Step 3 They place the bottom of the paper into a 1cm depth of water in a beaker.
- Step 4 They cover the beaker with a sheet of glass and leave it until the water has soaked almost to the top of the paper.
- Step 5 They remove the paper from the beaker and leave it to dry.

This is what the paper looks like at the end of this process.



- (a) (i) What is the name given to the process used by the scientists?

Choose from this list.

Put a ring around the correct answer.

chromatography

crystallisation

distillation

filtration

[1]

- (ii) Why did the scientists keep the beaker covered while the water soaked up the absorbent paper?

Put a tick (✓) in the correct box.

To keep dust out of the beaker.

To stop the samples evaporating from the paper.

To stop water evaporating from the paper.

[1]

- (iii) Explain why the scientists use pencil instead of pen to mark the line and the sample labels on the absorbent paper?



(One mark is for correct spelling, punctuation and grammar).

.....

 [2+1]

- (b) The scientists decide that the orange drink, spot **A**, does not contain either of the banned colour additives, spots **B**, **C** and **D**.

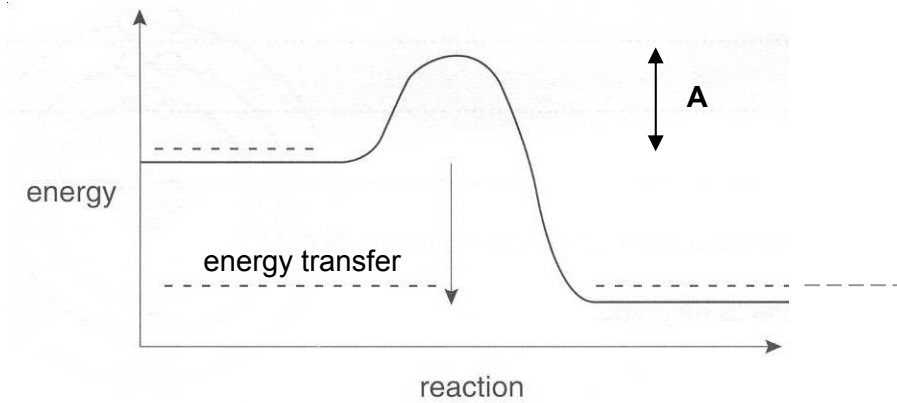
Explain how their results show this.

.....
 [1]

[Total: 6]

3. In the presence of sunlight, methane reacts with chlorine.

(a) This is an energy level diagram for the reaction.



(i) Add the following labels to the diagram.

products

reactants

[1]

(ii) This reaction is exothermic.

Explain how the energy level diagram shows this.

(One mark is for a clear, ordered answer.)

.....

 [2+1]

(iii) What is the quantity of energy marked **A** on the diagram?

Put a tick (✓) in the correct box.

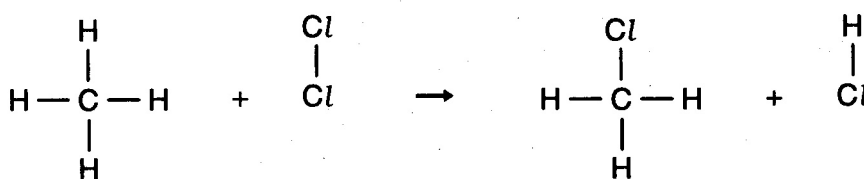
Potential energy

Activation energy

Chemical energy

[1]

(b) This is the equation for the reaction between methane and chlorine.



This table shows the bonds broken and made during this reaction, and the energy changes involved. All energy quantities are in kJ.

bond broken	number of bonds	bond energy	energy change	bond made	number of bonds	bond energy	energy change
C—H	1	435	435	C—Cl	1	346	
Cl—Cl	1	243	243	H—Cl	1	452	
Total energy change from bonds broken			678	Total energy change from bonds made			

(i) Finish the table by filling in the three empty boxes to show the energy changes from bonds made.

[3]

(ii) For a reaction

Energy transfer = (Energy change from bonds broken) – (Energy change from bonds made)

Work out the energy transfer for this reaction.

Energy transfer = kJ [1]

(iii) How does this value show that the energy change is exothermic?

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

[Total: 10]

4. Esters are chemicals that are responsible for many of the flavours in foods.

(a) Which two types of organic compound react together to make an ester?

Draw a line between **one** name in **list 1** and **one** name in **list 2** to show the correct combination.

List 1

alkane

alkene

alcohol

carboxylic acid

List 2

alkane

alkene

alcohol

carboxylic acid

[1]

(b) The ester butyl butanoate has a pineapple flavour.

(i) Few esters used to flavour foods are extracted from fruits.

Most of these esters are produced by chemical synthesis.

Suggest why.

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

(ii) Butyl butanoate can be made by reacting butanol with butanoic acid.

Here are the formulae of some compounds.

A C_4H_{10}

B C_4H_8

C C_4H_9OH

D C_4H_9COOH

Which **one** of these formulae represents butanol?

.....[1]

(iii) The reaction between butanol with butanoic acid in acidic conditions reaches an equilibrium.

Which of the following statements are true about this reaction?

Tick (✓) the boxes to show which are the **two** best answers.

The reaction can go in either direction.

The reaction goes in the forward direction only.

The reaction mixture will contain only the ester.

The reaction mixture contains both reactants and products.

[2]

(c) Esters are also used in perfumes. They give the characteristic pleasant smell.

A typical perfume may contain just 1% esters and 99% ethanol.

Suggest why ethanol is present in the perfume.

(One mark is for the use of correct scientific words.)

.....
.....
..... [2+1]

(d) Fats and oils are esters of glycerol and fatty acids.

Animal fats and vegetable oils have some difference in structure and properties.

Tick (✓) the boxes to show which are **two** of these differences.

Animal fats are solid at room temperature but vegetable oils are liquid.

Vegetable oils are solid at room temperature but animal fats are liquid.

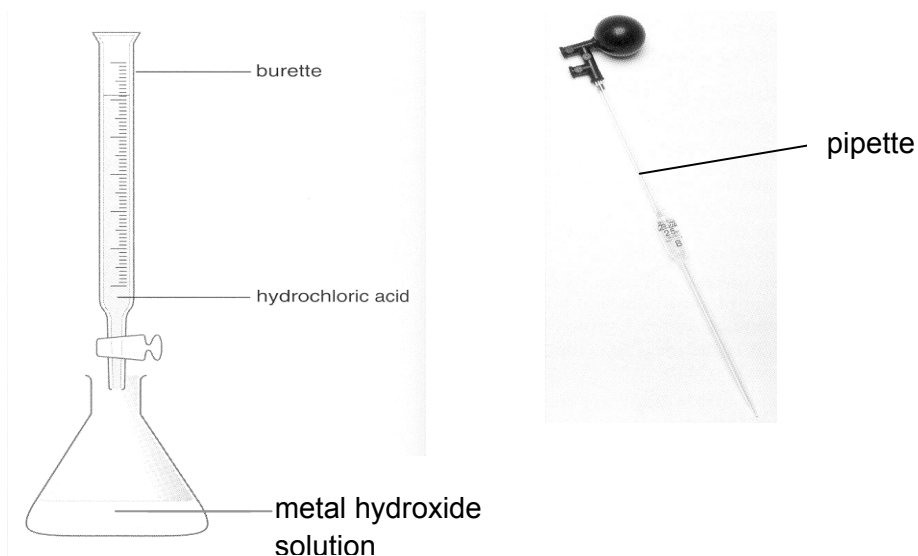
Animal fats are mostly saturated molecules but vegetable oils are mostly unsaturated molecules.

Vegetable oils are mostly saturated molecules but animal fats are mostly unsaturated molecules.

[2]

[Total: 12]

5. Alice carries out a titration to find the formula mass of a metal hydroxide. She uses apparatus shown in the diagram.



- (a) These are the instructions Alice follows to perform the titration.

They are in the wrong order.

- A Fill the burette with hydrochloric acid of known concentration.
- B Stop adding hydrochloric acid when the indicator changes colour.
- C Dissolve a known mass of metal hydroxide to make 1 dm³ of solution.
- D Add a few drops of indicator to the metal hydroxide solution.
- E Pipette 25 cm³ of the metal hydroxide solution into a conical flask.
- F Add hydrochloric acid from the burette to the conical flask a little at a time.

Show the correct order for the instruction by writing the letters of the statements in the boxes. The first one has been done for you.

A					
---	--	--	--	--	--

[4]

(b) Which of these chemicals could be used as an indicator?

Put a tick (✓) in the correct box.

sodium hydroxide

phenolphthalein

sulfuric acid

[1]

(c) Alice repeats her titration several times, and works out an average value.

Here are her results.

titration number	1	2	3	4	5
final burette reading (in cm ³)	21.4	41.6	20.1	40.3	20.3
initial burette reading (in cm ³)	0	21.4	0	20.1	0
volume of acid used (in cm ³)	21.4	20.2	20.1	20.2	20.3

(i) Why did Alice carry out several titrations and work out an average?

Tick (✓) the boxes to show which are the **two** best reasons.

To make it a fair test.

To obtain a more reliable value.

To get a more accurate value.

To overcome limitations in the technique.

[2]

(ii) When Alice works out the average she does not use the value for titration number 1.

Suggest why.

.....[1]

(d) The formula of the metal hydroxide Alice used is MOH, where M represents the metal. Using her results Alice works out that the formula mass of MOH is 40.

(i) Work out the atomic mass of metal M.

You are advised to show how you work out your answer.

(Relative atomic masses: H = 1, O = 16.)

atomic mass =[2]

(ii) What is the name of this metal?

Use the Periodic Table to help you.

.....[1]

[Total: 11]

1	2											3	4	5	6	7	8		
		Key																	
		relative atomic mass atomic symbol name atomic (proton) number																	
		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 Sb 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								

*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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GCSE

CHEMISTRY A

Chemistry A Unit 3 Ideas in Context plus C7

Specimen Mark Scheme

Maximum mark for this paper is [55]

F **A323/01**

1 hour

This specimen mark scheme consists of 4 printed pages.

Question Number	Answer	Max Mark
1(a)i	because chillies are red / to look attractive / to attract buyers	[1]
1(a)ii	it is carcinogenic / it causes cancer / it has been found to cause live cancer (in animal tests)	[1]
1(a)iii	a colour for boot polish/industrial solvents/petrol	[1]
1(b)	17 days accept: 18 days	[1]
1(c)	Sudan 1 was added to chilli powder; chilli powder was used to make Worcester sauce; Worcester sauce was used as an ingredient (for a wide variety of food products) QWC – The candidate has attempted to answer the question using statements which are ordered in a logical way.	[3] [1]
1(d)	the amount of Sudan 1 in food products is very small/is in parts per billion / Sudan 1 has not been shown to cause cancer in humans / Sudan 1 has been shown to cause cancer only in animals	[2]
1(e)i	any three: to increase reliability; to get an average/mean; to identify/discard outliers; because content in samples varies; to avoid a one-off error	[3]
1(e)ii	it is an outlier / it is far different from all of the other results	[1]
1(e)iii	10 to 14; 12	[2]
Total marks		[16]
2(a)i	chromatography	[1]
2(a)ii	to stop the samples evaporating from the paper	[1]
2(a)iii	pen ink dissolves in water, pencil lead does not; pen ink would 'run' with the solvent/spots;	[1] [1]
	QWC one mark for spelling, punctuation and grammar	[1]
2(b)	B, C and D travelled a different distance (to spots in A);	[1] [1]
Total marks		[6]

3(a)i	top left – reactants; bottom right – products	[1]
3(a)ii	reactants have higher energy than products; difference is released (to surroundings (as heat)) QWC mark is for making the connection between difference in (energy) level and heat/energy given out	[1] [1] [1]
3(a)iii	activation energy	[1]
3(b)i	from top to bottom: unit not required 346; 452; 798	[3]
3(b)ii	678 – 798 = –120 kJ accept: 120 kJ	[1]
3(b)iii	value is negative	[1]
	Total marks	[10]
4(a)	line from alcohol on left to carboxylic acid on right / line from on carboxylic acid left to alcohol on right	[1]
4(b)i	Any three: synthesis is cheaper; extraction from fruit is more complex; synthesis is quicker/fruit take a long time to grow; land is needed to grow food crops	[3]
4(b)ii	C	[1]
4(b)iii	the reaction can go in either direction; the reaction mixture contains both reactants and products	[1] [1]
4(c)	ethanol is a solvent (for the esters); ethanol is volatile/evaporates quickly (to leave esters on skin) QWC one mark is for correct use of two of the scientific words solvent; volatile; evaporate(s)	[1] [1] [1]
4(d)	animal fats are solid at room temperature but vegetable oils are liquid; animal fats are mostly saturated molecules but vegetable oils are mostly unsaturated molecules	[1] [1]
	Total marks	[12]

5(a)	(A) C E D F B one mark each for C before E; E before D; D before F; F before B	[4]
5(b)	phenolphthalein	[1]
5(c)i	to obtain a more reliable value;	[1]
	to overcome limitations in the technique	[1]
5(c)ii	it is an outlier	[1]
5(d)i	$\text{OH} = 16 + 1 = 17;$	[1]
	$40 - 17 = 23$	[1]
5(d)ii	sodium allow ecf from (d)i	[1]
	Total marks	[11]
	Overall marks	[55]