

Cambridge NATIONALS

# COMBINED FEEDBACK ON THE JUNE 2013 EXAM PAPER

UNIT R072/01: HOW SCIENTIFIC IDEAS HAVE DEVELOPED

# SCIENCE Level 1/2



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### **INTRODUCTION**

This resource brings together the questions from the June 2013 examined unit (R072/01), the marking guidance, the examiner's comments and the exemplar answers into one place for easy reference.

The marking guidance and the examiner's comments are taken straight from the Report to Centre for this question paper.

The Question Paper, Mark Scheme and the Report to Centre are available from:

http://www.ocr.org.uk/qualifications/cambridge-nationals-science-level-1-2-j815/

Tuesday 14 May 2013 - Morning LEVEL 1 CAMBRIDGE NATIONAL IN SCIENCE R07201 How scientific ideas have developed	Cambridge National	Cambridge Nationals Cambridge Nationals Science Level 1/2 Cambridge National Certificate in Science J815
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### **PRE-RELEASE MATERIAL**

The question paper is based on a pre-release article issued to centres, which is required to answer question 1.

A case study provides the context for the first questions (15 marks) on the paper, targeting learning objective 2 and learning objective 3, but using knowledge and understanding from one or more parts of learning objective 1.

The case study presents information about the work of some modern scientists, including information about their research and some of their results. Pre-release material sent to centres before the examination gives learners an opportunity to become familiar with the case study.

The pre-release material can be found here:

http://www.ocr.org.uk/Images/167834-question-paper-unit-r072-01-how-scientific-ideas-have-developed-pre-release-resourcebooklet.pdf

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# **GENERAL EXAMINER COMMENTS ON THE PAPER**

This Level One examination gives candidates the opportunity to study the processes by which scientific ideas have been developed. This is achieved by considering a number of important steps in the development of modern understanding.

The first question relates to the pre-release material and provides 25% of the marks for the whole paper. Candidates who did well on the whole paper had clearly worked on this pre-release case study material with their teachers in class before the examination. Very few marks were obtained by simply copying from the document but many marks were accessible to those who had considered and discussed the pre-release material.

The language of the examination was inclusive and there was no evidence that any candidate were disadvantaged by this or cultural issues. There was no evidence of time pressures or other constrain



Duration: 1 hour



cultural issues. There was no evidence of time pressures or other constraints for candidates.

Where multiple choice questions ask for a specific number of responses (eg question 1g) candidates cannot gain full marks by giving fewer or more responses. The Level One paper usually states how many responses are required, although this may not always be the same as the number of marks awarded. Candidates are allowed to use a calculator in this examination but a number of candidates resorted to using arithmetical workings in the margins of their scripts.

OCR

# Question 1 (a), (b) and (c)

	This question is based on the case study 'Cancer in children around Sutro Tower, San Francisco'.
(a)	Look at the data in Table 1.
	'A higher percentage of children living within 500m of the mast developed cancer compared to the children in th control group'
	Use calculations to show that this statement is true.
	2 / 144 × 100 = 1.38 / 1.39%
	19 / 27500 × 100 = 0.06(9) / 0.07% [2]
(b)	The original hypothesis for the study was that 'Exposure to radio and microwave radiation causes cancer in childr living near the tower'.
	Give <b>two</b> pieces of information in the case study that do <b>not</b> support the hypothesis.
	Claim that scientific studies do not agree
	People are exposed to other sources of radiation
C	Other example answers:
•	Too few cases
•	Too few cases There are other causes of cancer
• • •	Too few cases There are other causes of cancer Idea that there are a significant number of cancer cases not near the tower
•	Too few cases There are other causes of cancer Idea that there are a significant number of cancer cases not near the tower [2]
(c)	Too few cases There are other causes of cancer Idea that there are a significant number of cancer cases not near the tower [2] People who live near the tower do not all get the same exposure to FM and UHF radio waves.
(c)	Too few cases There are other causes of cancer Idea that there are a significant number of cancer cases not near the tower People who live near the tower do not all get the same exposure to FM and UHF radio waves. Look at Graph 1 in the article.
(c)	Too few cases There are other causes of cancer Idea that there are a significant number of cancer cases not near the tower People who live near the tower do not all get the same exposure to FM and UHF radio waves. Look at Graph 1 in the article. Describe how the exposure to UHF and FM radio waves change as you move away from the tower.
(c)	Too few cases There are other causes of cancer Idea that there are a significant number of cancer cases not near the tower [2] People who live near the tower do not all get the same exposure to FM and UHF radio waves. Look at Graph 1 in the article. Describe how the exposure to UHF and FM radio waves change as you move away from the tower. Goes up and down
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- 1(a) Allow two correct rations for (1 mark).
- Allow 1 in 72 (chance); 1 in 1447 (chance).
- 1(b) Not a cluster at the tower / map shows even distribution of cancer case.

#### **Examiner comments**

This question related to the pre-release material. Part (a) was found to be challenging and most candidates did not have a sound understanding of the mathematical concepts of percentages, or the calculations required. Some candidates gave answers lacking any mathematical content, and some did not attempt to answer at all. Many candidates did not appear to have a calculator.

Candidates who had studied the pre-release material in class were likely to have considered the section "Other studies and opinions" so could often suggest two ideas that did not support the hypothesis for part (b). Many candidates also used the information in Table 1 to state there were too few cases or that there were more cancer cases in the control group than the study group. Many answers for part (c) lacked the required detail, often referring only to FM and UHF decreasing. Some candidates gave confused responses, or continued talking about cancer cases.

[2]

[2]

# Question 1 (d), (e) and (f)

(d) Look at Graph 2 in the article.

Which statements about Graph 2 are true and which are false?

Put a tick ( $\checkmark$ ) in one box in each row.

	True (🖍 )	False (🗸 )
The nearest to the tower, the lower the risk of developing cancer		V
There is a correlation between developing cancer and exposure to radiation	V	
The graph proves that radiation causes cancer		V

(e) The case study says that some types of radiation are genotoxic.

What do you think the case study means by the word 'genotoxic'?

# DNA is damaged

#### Other example answers:

- Chromosomes are damaged
- Genes are damaged

(f) Look at the information about the study around a similar tower in the UK.

The scientists who did the original study around Sutro Tower were very interested in the UK study.

Explain why.

#### Same type of study

#### Other example answers:

- They looked at the same problem
- Findings are similar
- Supports their study

[2]

- 1(d) 3 correct = 2 marks 2 correct = 1 mark
- 1(e) Damages genetic material 1 mark

#### **Examiner comments**

Most candidates were able to correctly identify from Graph 2 that the nearer the tower the greater the risk of developing cancer and that there is a correlation between developing cancer and exposure to radiation for part (d). A significant number of candidates however thought incorrectly that this graph proved that radiation causes cancer. Most candidates could identify that the term genotoxic refers to genes or DNA but fewer linked it to the idea of damage in part (e). Many candidates simply stated that it was toxic or poisonous, or recycled the fact that protein synthesis is disrupted which is in the pre-release material. Stronger candidates could link the idea of a similar type of study supporting the Sutro Tower study by providing more evidence. Most candidates gained a mark for the latter point only in part (f).

# Question 1 (g)

Tick (🗸 )
~
~
[2
[Total: 15

#### **Examiner comments**

Most candidates recognised correctly that new techniques to diagnose cancer have been developed but not as many recognised that the equipment used to measure was not available a hundred years ago.

# Question 2 (a)



#### **Examiner comments**

Some candidates did not seem to have a sound understanding of the process of rock formation and although many candidates recognised that rock layer D was the oldest, a common mistake was to choose Level A rock as the oldest. Most candidates recognised either that there were fish present in layer C, or that there must have been water present in the environment.

### Question 2 (b)

) Conditions have changed over time in the area where these layers of rock formed.	
(i) What do the types of fossils in <b>layer C</b> tell you about the conditions when this rock for Explain your answer.	ormed?
Must have been a sea shore	
because the rock contains fish	
Other example answers:	
<ul> <li>Must have been a beach because the rock contains shells</li> </ul>	
<ul> <li>Must have been sea / water because the rock contains sand</li> </ul>	
	[2]
(ii) How do the other rock layers show that the conditions have changed over time?	
No shells in some layers	
Mud / animals in other layers	
Other example answers:	
• So not a beach / sea	
Must have been some land	
	[2]

#### **Examiner comments**

Stronger candidates explained the link between the two facts for part (bi). Most candidates recognised that there were differences in the rock layers, but then many simply repeated text from the question or described what was in the layers without attempting to show how conditions had changed over time or offer any explanation.

# Question 2 (c) and (d)

(c) Different scientists have put forward ideas about changes to the Earth.

Draw lines to connect each scientist with the evidence he collected and the change to the Earth he investigated.



(d) Darwin also used evidence from fossils in the rocks.

What theories did Darwin use this evidence to support?

Put ticks ( $\checkmark$ ) in the boxes next to the **two** correct answers.

Theories	Tick (🗸 )
Selective breeding	
Natural selection	$\checkmark$
Evolution	$\checkmark$
Classification by genus and species	
Dominant and recessive characteristics	
	[2]

#### Mark Scheme Guidance

2 (c) LHS correct = 1 mark RHS correct = 1 mark

#### **Examiner comments**

Most candidates could link the evidence supplied with the correct change to the earth but were less successful in correctly linking each scientist to their particular evidence in part (c). Most candidates could correctly link Darwin to one of his theories, most commonly Evolution, but were less clear about his other theory of Natural Selection.

### Question 3 (a)

3 Alex goes on holiday to a very hot place. Ben goes on holiday to somewhere very cold.





(a) Use ideas about temperature control to explain what is happening to Alex and Ben.

The quality of written communication will be assessed in your answer to this question.

Alex sweats to cool body back down Ben shivers to warm body back up Explanations Sweating cools by evaporation Shivering keeps warm by muscle contraction

#### Other example answers:

#### **Body temperature**

· Idea that temperature regulation keeps body temperature normal.

#### Alex and Ben

- Alex skin temperature is above core temperature.
- Ben skin temperature is below core temperature.
- Both core temperatures are the same.

#### **Explanations**

- Body keeps core temperature constant.
- · Idea that shivering and sweating keep temperature constant.
- Normal temperature is 37°C

[6]

This question is targeted at grades up to M.

#### Level 3 (5–6 marks)

Gives **explanations** for the data about Alex and Ben. Quality of written communication does not impede communication of the science at this level.

#### Level 2 (3–4 marks)

Makes some points about **body temperature** and makes points about both **Alex and Ben**. Quality of written communication partly impedes communication of the science at this level.

#### Level 1 (1–2 marks)

Makes some points about **body temperature** or makes points about **Alex and/or Ben**. Quality of written communication impedes communication of the science at this level.

#### Level 0 (0 marks)

Insufficient or irrelevant science. Answer not worthy of credit.

#### Accept Level 2 answers e.g. vasoconstriction, references to hypothalamus etc.

#### **Examiner comments**

This was a six-mark extended-writing question which was marked using level of response marking. Stronger candidates attempted to explain how temperature control would be achieved by using the information shown in the diagram which gained a level 2 mark, and a few offered very good explanations of both heating and cooling and so gained a level 3 mark. The majority of candidates however merely restated information from the diagrams and offered little or no explanation of how or why these processes took place.

### Question 3 (b)

(b) Another control system in the body is involved in the control of glucose concentration in the blood. Amir is a doctor. He uses a glucose monitor to test the glucose concentration in blood.

He tests the blood of a patient every half hour after the patient has eaten.

He repeats his test several times.

The table shows his results.

Time after eating i	n hours	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Glucose	Test 1	5.1	5.6	6.1	6.6	7.1	6.7	6.3	5.9	5.4
concentration in	Test 2	4.5	4.9	5.3	5.7	6.1	5.8	5.4	4.9	4.6
blood in mmol/l	Test 3	4.8	5.2	5.6	6.0	6.4	5.9	5.6	5.3	4.9

(i) Describe the change in glucose concentration during **Test 1**.

Increases	
then falls	
	[2]

(ii) Amir thinks that the data from the tests is of good quality because it is reliable.

Why does he think this?

Put a tick ( $\checkmark$ ) in the box next to the correct answer.

The results for all of the tests show a similar pattern	V
All of the measurements are to one decimal place	
He took all the measurements carefully	
The values do not change very much over time	
	[1]

#### **Examiner comments**

The majority of candidates gave good answers for part (bi) by noting that the level of glucose rose and then fell. The majority of candidates recognised the correct response that all the results showed a similar pattern. Some candidates lost this mark however by incorrectly reading the question and ticking another response as well in (b ii).

### Question 3 (c) and (d)

(C) Amir does another test (lest 4	ir doe	anothe	r test (	Test 4	<b>I</b> ).
------------------------------------	--------	--------	----------	--------	-------------

He finds that the change in glucose concentration in **Test 4** is different from Tests 1 to 3.

Time after eating i	n hours	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Glucose concentration in blood in mmol/l	Test 4	5.0	5.4	5.9	6.3	6.8	6.3	5.8	5.5	6.4

(i) How is the change in glucose concentration in **Test 4** different from Tests 1 to 3?

Goes up again

Other example answer:

• Goes up twice

[1]

(ii) Which of the following statements about **Test 4** might explain this difference?

The patient ate a snack during the test	V
Amir should have taken readings more often	
The patient did not eat a meal at the start	
Amir took the last reading much later than he should	
Amir read the glucose monitor wrongly	V
	[2]

(d) Glucose concentration in the blood and body temperature are controlled by different systems in the body.Draw straight lines to link the correct **control system** for glucose concentration in the blood and body temperature.



#### **Examiner comments**

Part (ci) was less successfully answered than the similar question (bi); most candidates correctly stated that the glucose level rises again, some candidates however gave confused responses indicating that they did not compare the data presented in the two tables effectively. For (c ii) the majority of candidates recognised one correct response, either that the patient ate a snack during the test, or that Amir read the glucose monitor wrongly. Fewer candidates recognised both of these correct answers. Many candidates attempted to answer part (d) by connecting the glucose concentration in the blood and body temperature boxes to two control systems each rather than choose one control system for each. Candidates who made errors frequently chose the binomial system as an incorrect response for one or the other systems.

### Question 4 (a)



#### **Mark Scheme Guidance**

4 (ai) Quality of written communication: answer is clear and easy to understand at first reading.

#### **Examiner comments**

Candidates found this question challenging. Many candidates failed to give a similarity between the orbits for the first part and gave a difference in the orbits, which is the answer to the next question and so failed to score in each section. For part (a ii) the quality of written communication was assessed and the majority of the stronger candidates were awarded this mark. There was a wide variety of erroneous answers to this question from weaker candidates.

### Question 4 (b) and (c)

(b) Scientists have observed that stars are moving away from the Earth.

How do scientists explain why the stars are moving away from the Earth?

Put ticks ( $\checkmark$ ) in the boxes next to the **two** correct statements.

Stars move on invisible spheres	
The Universe started with the Big Bang	$\checkmark$
The gravity of the Earth attracts stars	
The Universe is expanding	$\checkmark$
Our Sun is at the centre of the Universe	

[2]

(c) Scientists use light to take measurements of very distant stars and galaxies.

Why is light useful for taking these measurements?

Put ticks ( $\checkmark$ ) in the boxes next to the **two** best answers.

	[2] [Total: 8]
Scientists can shine light on distant stars from Earth	
Light always travels at the same speed	V
Stars and galaxies give out light that can be seen from Earth	$\checkmark$
Light carries a lot of data because it travels very slowly	
Scientists can vary the speed of light to take readings	

#### **Examiner comments**

Most candidates could identify that the Universe is expanding, but then many also thought that the stars move on invisible spheres. Most candidates knew that stars and galaxies give out light that can be seen from earth, but few knew the other correct answer, that light always travels at the same speed. The most frequent incorrect response chosen was that scientists can vary the speed of light to take readings.

### Question 5 (a)

5 At the start of the 1950s, scientists were interested in working out the structure of DNA.

They looked at X-ray crystallography photographs.

The diagram shows scientists talking about three different models for the structure of DNA.



Watson and Crick's new idea (Model 3) was accepted by scientists as the best model.

Describe the similarities and differences between Model 1, Model 2 and Model 3.

The quality of written communication will be assessed in your answer to this question.

#### Differences

(a)

Model 1 bases on the outside	
Model 2 bases on the outside	
Model 3 has bases on the inside	Other example answers:
Model 1 is held together with magnesium Model 2 has hydrogen atoms Model 3 bases hold helix together Similarities All models have sugar All have phosphate	<ul> <li>Differences</li> <li>Model 1 has three chains</li> <li>Model 2 has three chains</li> <li>Model 3 has two chains</li> <li>Model 3 has double helix</li> <li>Similarities</li> <li>All have chains</li> <li>All have bases</li> </ul>
	[6]

This question is targeted at grades up to D.

#### Level 3 (5–6 marks)

Gives some similarities and identifies differences between all three models. Quality of written communication does not impede communication of the science at this level.

#### Level 2 (3–4 marks)

Gives some similarities and identifies differences between two models. Quality of written communication partly impedes communication of the science at this level.

#### Level 1 (1–2 marks)

Describes models without comparisons or gives some similarities between the models. Quality of written communication impedes communication of the science at this level.

#### Level 0 (0 marks)

Insufficient or irrelevant science. Answer not worthy of credit.

#### **Examiner comments**

The first part of this question was a six-mark extended-writing question which was marked using level of response marking. Candidates tended to score better on this question than the other six-mark extended-writing question (Q3a), and demonstrated a sound knowledge of the subject matter. Most candidates could identify similarities between the models of DNA structure and at least one difference. Some candidates lost marks for not including enough details in their responses and making rather vague statements.

## Question 5 (b) and (c)

The model explained the evidence available at the time	V
The model did not fit any of the evidence available	
Other scientists did not agree	
They published their ideas too quickly	
New evidence caused them to change their ideas	V
William Bragg developed the technique of X-ray crystallography in 1912.	
Explain why this was important to the development of ideas about DNA.	
Examine DNA structure	
Shows where bases/chains are	
her example answers:	
Evidence against (Pauling's structure)	
vidence for double helix	

#### **Examiner comments**

Most candidates chose the correct answer for part (b), that the model explained the evidence available at the time, and many also correctly chose the answer that new evidence caused them to change their ideas. In part (c), the uses and principles of X-ray crystallography were not well understood and many candidates erroneously thought that X-ray crystallography allowed the scientists to see pictures of DNA, or made vague non-specific statements about finding new diseases. No candidates gained 2 marks for their response.

### Question 5 (d) and (e)

 (d) Franklin also worked out the structure of DNA.

 She took a long time to publish her ideas.

 Why does it take some scientists a long time to publish their ideas?

 Put ticks (✓) in the boxes next to the two best answers.

 They recheck data

 They find out if other scientists on the same team agree with them

 They work on too many other projects

Scientists do not want to share information with each other

Publishing ideas is not important to scientists

[2]

#### (e) Model 3 for the structure of DNA is still accepted today.

Which of the statements about the structure of DNA are true and which are false?

Put a tick ( $\checkmark$ ) in one box in each row.

	True (🗸 )	False (🗸 )
The bases form rings in groups of three		~
Base A joins to base T and base C joins to base G	V	
Genes are made from DNA	V	
The bases cannot join to each other		V

[2]

[Total: 14]

5 (e) All correct = 2 marks 2/3 correct = 1 mark

#### **Examiner comments**

The majority of candidates correctly identified that scientists would check their data (d) and find out if scientists on the same team agreed with them and scored both marks. Most candidates knew 3 out of 4 of the correct responses (e); the most frequent error was that the base pairs statement was thought to be false.



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