OXFORD CAMBRIDGE AND RSA EXAMINATIONS

LEVEL 2

R072/02

CAMBRIDGE NATIONAL IN SCIENCE

How scientific ideas have developed

WEDNESDAY 6 JANUARY 2016:
Morning

DURATION: 1 hour
plus your additional time allowance

MODIFIED ENLARGED 24pt

Candidate forename		Candidate surname	

Centre number						Candidate number				

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:
Insert (R072/02/I – inserted)

OTHER MATERIALS REQUIRED:
Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

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INSTRUCTIONS TO CANDIDATES

The Insert will be found inside this document.

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

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.

Your quality of written communication is assessed in questions marked with a pencil (✎).

Any blank pages are indicated.

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Answer ALL the questions.

1 This question refers to the case study THE ORGANISATION MAN in the insert.

(a) (i) Look at FIG. 1 and FIG. 2 in the case study.

Which extra level of classification has been added since the days of Linnaeus?

_____ **[1]**

(ii) Why did Linnaeus NOT use DNA in his classification system?

_____

_____ **[1]**

(b) Look at the information about classifying animals and FIG. 3.

Why would Linnaeus put a duck in the same group as a pelican, and how would they be distinguished?

_____

_____

_____ **[2]**

(c) Linnaeus published his '*Systema naturae*' in 1735.

(i) Give TWO reasons why it was important for him to publish '*Systema naturae*'.

_____

_____

_____ [2]

(ii) Suggest TWO reasons why the 13th edition of '*Systema naturae*' was much longer than the first edition.

_____

_____

_____ [2]

(d) Linnaeus lived long before Darwin and Lamarck.

In what ways were Linnaeus' ideas related to the work of Darwin and Lamarck?

_____

_____

_____

_____ [2]

(e) Look at FIG. 4 in the case study.

(i) What characteristic is shared by all the animals shown in the diagram?

_____ [1]

(ii) Which animal on the cladogram has a skeleton which is not made of bone?

_____ [1]

(iii) How does the cladogram show that a rabbit is similar to a lizard and how are they different?

_____

_____

_____

_____

_____ [3]

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2 **Mendel did some plant breeding experiments using pea plants.**
Some of the pea plants were tall (about 200 cm) and others were short (about 30 cm).

Eve repeated some of Mendel's experiments.
She used pure breeding plants.

In EXPERIMENT 1, Eve crossed a pure breeding TALL plant with a pure breeding SHORT plant. All the offspring (the F1 generation) were tall plants.

EXPERIMENT 1

TALL × SHORT parents **F1 GENERATION**

In her second experiment, Eve crossed plants from the F1 generation.

EXPERIMENT 2

F1 PLANT × F1 PLANT **F2 GENERATION**

She tried the second experiment several times. Each trial gave her a set of results.

These are her results:

TRIAL	NUMBER OF TALL PLANTS	NUMBER OF SHORT PLANTS
A	30	10
B	60	21
C	37	13
D	90	28

(a) In another trial (E), Eve grew 110 F2 plants but 10 did not survive.

How many plants of each type would Eve expect to survive?

Tall plants: _____

Short plants: _____ [2]

(b) What conclusions can be made from Eve's results and how can these be explained using the theory of genetics?

You may use the space below to include a genetic diagram in your answer.

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

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

(c) Eve thought that her experiments were reliable. How could she justify this?

_____

_____

_____ **[2]**

3 (a) **Colin has been studying the sky at night using a powerful telescope.**
He can see THE MOON, STARS, PLANETS and GALAXIES.

Put these in order of increasing distance from the surface of the Earth.

Closest	_____
	_____
	_____
Furthest away	_____

[3]

(b) **Colin has read that Newton proposed an explanation for the movement of the planets in our Solar System.**

What was Newton's explanation?

_____

_____

_____ **[2]**

(c) Colin has heard that scientists measure redshift to help them study the Universe.

(i) What is REDSHIFT?
Put a tick (✓) in the box next to the best answer.

Light from the stars is red. ☐

Light from the sky is blue. ☐

Light from stars has a longer wavelength than expected. ☐

Red light travels faster than blue light in space. ☐

[1]

(ii) What do measurements of redshift show?
Put a tick (✓) in the box next to the best answer.

Distant stars are moving away from Earth. ☐

Nearby stars are moving towards Earth. ☐

The Sun is the star nearest to Earth. ☐

The stars are moving faster than light. ☐

[1]

(d) Colin's friend has told him that scientists also measure microwave background radiation.

What is MICROWAVE BACKGROUND RADIATION used as evidence for?
Put a tick (✓) in the box next to the best answer.

cooling of the Universe ☐

heating of the stars ☐

movement of the galaxies ☐

the force of gravity ☐

climate change ☐

[1]

(e) In 1929, Edwin Hubble worked out that the Universe was expanding very rapidly.
He calculated a constant that showed how fast it was expanding.

Suggest why it was important that Hubble published his work.

_____

_____ [2]

(f) Hubble decided that his observations showed that the Universe was expanding.

He showed this by calculating the HUBBLE CONSTANT. He thought this had a value of about 500 km/s/Mpc.

The Hubble Constant has been worked out again by many scientists using modern telescopes. These are very different from the value that Hubble worked out.

The graph shows the values using data from four modern powerful telescopes, A, B, C and D.

(i) Which of these four telescopes (A, B, C or D) has the mean value that is closest to Hubble's value of 500 km/s/Mpc?

_____ [1]

(ii) Suggest why a scientist would expect the value from telescope A to be close to the true value.

_____ [1]

4 **Martyn takes part in a long cycle race.**
His core body temperature changes during and after the race, as shown in the table below.

	Before race	End of race	Ten minutes after race	An hour after race
Temperature (°C)	37.5	39.5	35.5	37.5

(a) Explain what is happening in Martyn's body to cause the changes in temperature in the table.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

(b) Martyn is worried about the changes in his temperature.

What can he do to find out if the temperatures he measured are within an acceptable range for this type of activity?

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

_____

_____

_____

_____ **[4]**

5 Kyle has read that his reaction times will be shorter if he plays computer games a lot.
He tests his reaction times using a mobile phone app.
He has to press a button when he sees the screen change.

(a) The stages in the process are given below.

A RECEPTOR detects the change on the screen.
An impulse travels through a SENSORY NEURONE.
The CENTRAL NERVOUS SYSTEM responds.
An impulse travels through a MOTOR NEURONE to an EFFECTOR.
An EFFECTOR makes him press the button.

(i) Where in his body is the RECEPTOR?

_____ [1]

(ii) Name a part of the CENTRAL NERVOUS SYSTEM.

_____ [1]

(iii) What is the EFFECTOR that makes his finger move to press the button?

_____ [1]

(b) Kyle is the only person in his family who plays computer games a lot.
Each member of the family uses the mobile phone app to measure their own reaction times on five occasions.

Their results are shown in the table below.

	REACTION TIMES (ms)					MEAN REACTION TIME (ms)
KYLE	290	310	270	280	300	290
SISTER	280	310	290	310	310	
FATHER	380	400	420	370	350	384
MOTHER	360	390	360	400	390	380

(i) Give TWO reasons why each person should take the test five times.

_____

_____ [2]

(ii) Calculate the mean reaction time for Kyle's sister.

Show your working.

mean reaction time = _____ ms [2]

(c) Kyle says that his experiment proves that people who play computer games a lot have shorter reaction times than those who do not. His father disagrees.

(i) What evidence from the experiment supports Kyle's conclusion?

_____

_____ [1]

(ii) What evidence from the experiment does NOT support his conclusion?

_____

_____

_____ [1]

(d) (i) Kyle's sister suggests that his data shows a different correlation.

What other correlation is shown in the data?

_____

_____

_____ [1]

(ii) Kyle's mother says that they cannot draw any valid conclusions from these measurements.

Explain why she thinks this.

_____

_____

_____ [1]

(e) Give TWO variables that need to be controlled to improve the validity of the results from Kyle's experiment.

1) _____

2) _____

[2]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.

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