

Candidate Forename						Candidate Surname				
Centre Number						Candidate Number				

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

A211/02

**TWENTY FIRST CENTURY SCIENCE
SCIENCE A**

**Unit 1: Modules B1 C1 P1
(Higher Tier)**

THURSDAY 14 JANUARY 2010: Morning

DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil

Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

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 42.**

Answer ALL the questions.

1 Read the article about stem cells.

GROWN TO ORDER

In the future it may be possible to repair damaged body parts using stem cells.

Scientists have added extra genes to skin cells.

The extra genes make the skin cells behave like embryonic stem cells.

Skin cells altered in this way have been used in mice to treat a disorder of the nervous system.

Making stem cells from skin cells might be useful.

It would no longer be necessary to use embryos to make stem cells.

(a) Complete the sentences about cells.

Embryonic stem cells can develop into any kind of cell. Therefore, stem cells are described

as _____.

During the development of multicellular organisms, stem cells become

_____.

[2]

(b) Therapeutic cloning has been used to produce stem cells for the treatment of some disorders.

The flow chart opposite illustrates the processes involved in therapeutic cloning.

Use the words provided to complete the flow chart.

Each word may be used once, more than once, or not at all.

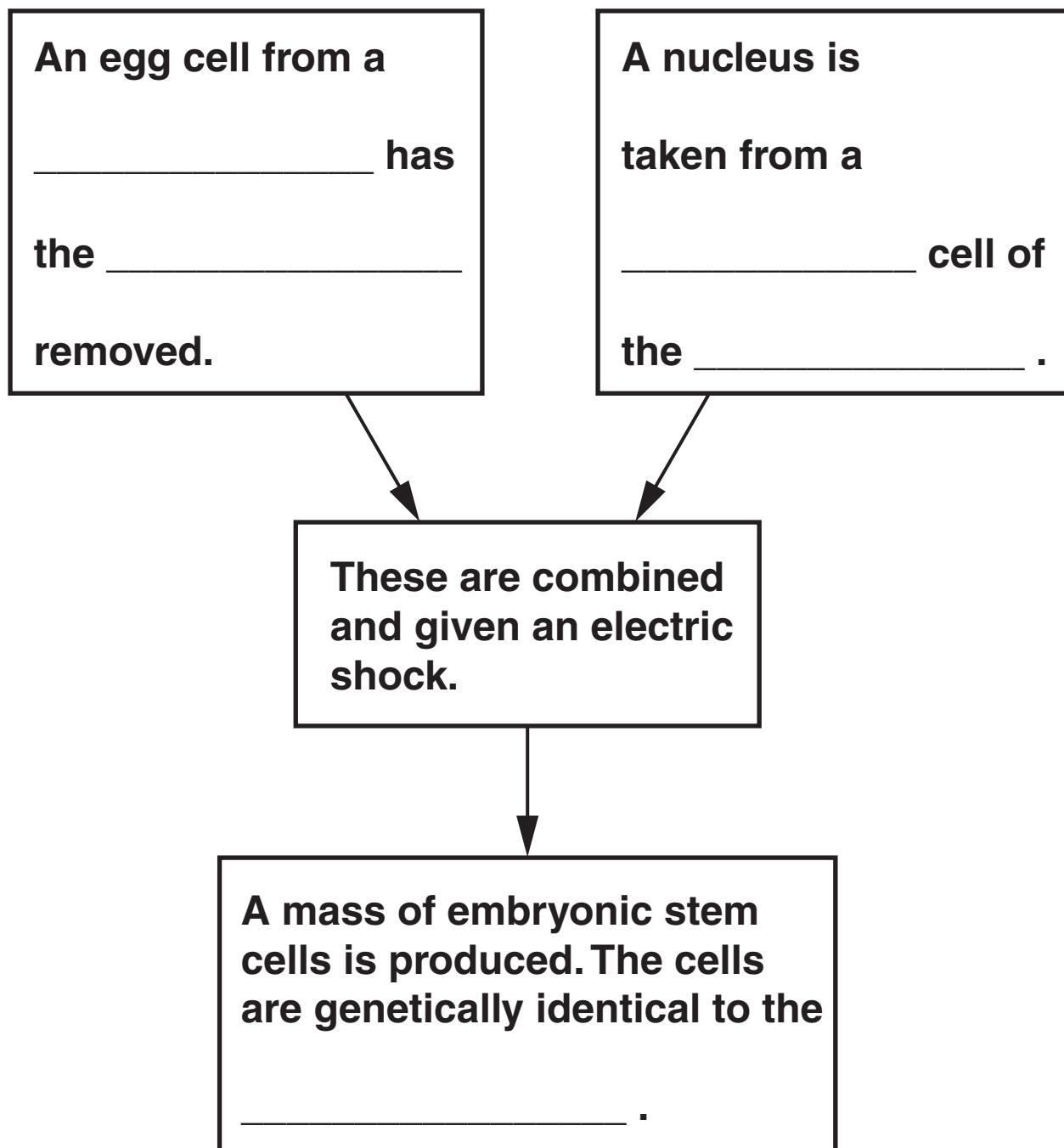
DONOR

EGG

NUCLEUS

PATIENT

SKIN



[2]

(c) The use of human embryos to produce stem cells has caused a lot of argument and discussion.

There are ethical and religious arguments against the use of human embryos to produce clones.

Suggest arguments against this use of human embryos which are NEITHER ethical NOR religious.

[3]

[Total: 7]

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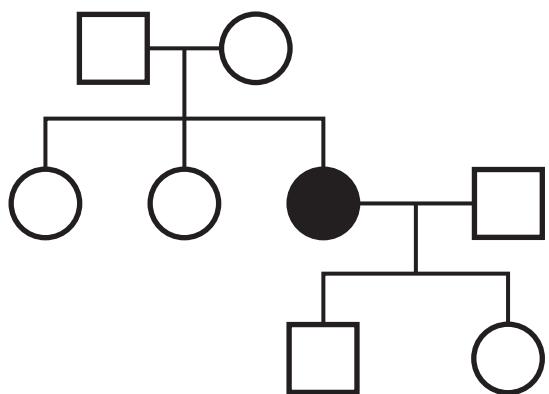
2 Phenylketonuria (PKU) is an inherited disorder.

PKU is caused by a faulty gene.

The faulty gene lets a chemical called phenylalanine build up in the body.

Too much phenylalanine causes serious health problems.

Look at this family tree.



- = male without PKU
- = male with PKU
- = female without PKU
- = female with PKU

(a) Use straight lines to link the best DESCRIPTION of the inheritance of PKU with the correct TWO EXPLANATIONS.

Join ONE description on the left to TWO explanations on the right.

DESCRIPTION

EXPLANATION

PKU is inherited in a similar way to cystic fibrosis.

Parents can be carriers of PKU.

PKU is inherited in a similar way to Huntington's disorder.

PKU is caused by a dominant allele.

PKU is inherited in a different way from cystic fibrosis or Huntington's disorder.

Parents cannot be carriers of PKU.

PKU is caused by a recessive allele.

[2]

(b) Put a tick (✓) in the box next to the correct definition of a gene.

A gene is an instruction to enable a cell to make ...

... a DNA molecule.

... an allele.

... a protein.

... a chromosome.

[1]

(c) Complete the sentence.

We all have _____ copies of each gene

because we inherit _____ copy from each of our parents.

[1]

(d) In the UK, all children are screened for PKU soon after birth.

In 2008, the US government passed laws preventing discrimination against people who have had a genetic screening test.

Suggest who may want to discriminate on the basis of a genetic screening test.

Explain why they may want to discriminate.

who may want to discriminate _____

why they may want to _____

_____ [1]

[Total: 5]

3 There are several examples in English history of kings blaming their wives for not producing male heirs.

Scientifically, the kings were wrong.

Complete the sentences to explain why.

The sex chromosome in a sperm cell is either

_____ or _____.

A gene on the _____ sex chromosome

triggers the development of _____ in males.

[2]

[Total: 2]

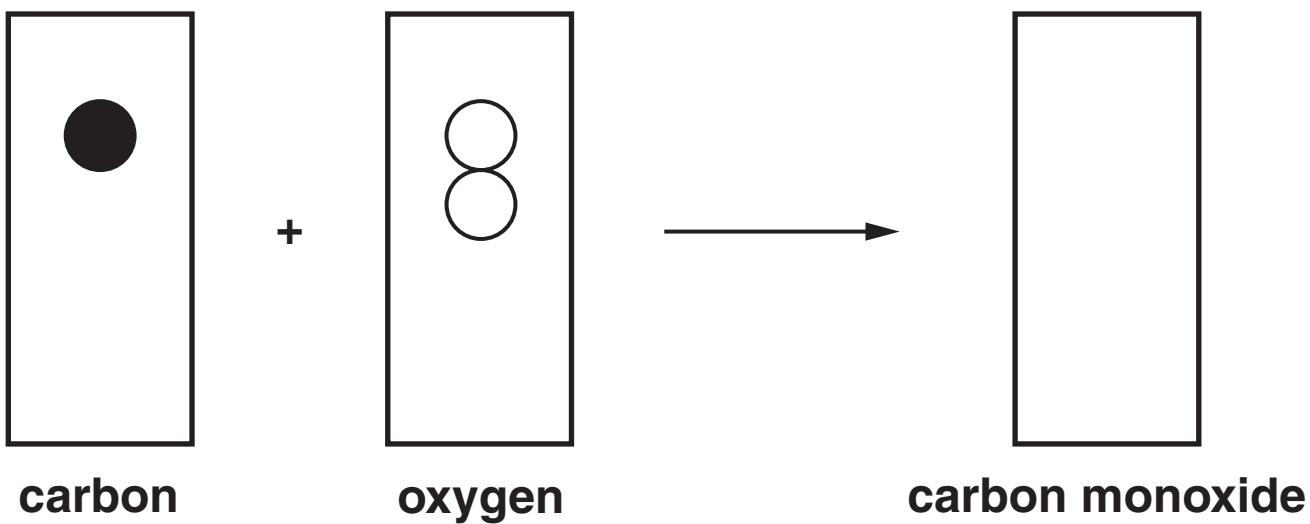
4 There are plans to build a coal-burning power station in Kent.

(a) Coal is mainly made of carbon atoms.

When coal burns INCOMPLETELY in oxygen, it makes carbon monoxide.

Complete the diagram to show how CARBON MONOXIDE is made from the incomplete combustion of coal.

Complete the diagram to show a balanced chemical reaction.



(b) Read the following extracts from a radio programme.

Two scientists are discussing the building of this coal-burning power station.

JANE JORDAN said

'When this power station is built, older ones will be shut down. The new power station is more efficient. This means there will be much less pollution from the new power station than from the old ones.'

'We should be able to stop all polluting gases reaching the air. Experimental devices have trapped the carbon dioxide so it can be buried in the ground.'

MIKE MORRIS said

'Coal-burning power stations make very large amounts of polluting carbon dioxide. Nobody has ever built a full scale power station that traps the carbon dioxide. I don't believe we can do it.'

'We should only be using non-polluting renewable sources of energy to produce electricity.'

(i) Who has made the following claims?

Put ONE tick (✓) in each row of the table to show whether the claim is made by JANE JORDAN, MIKE MORRIS, BOTH OF THEM or NEITHER OF THEM.

CLAIM	JANE JORDAN	MIKE MORRIS	BOTH OF THEM	NEITHER OF THEM
Air quality can be improved.				
Small-scale processes cannot always be replicated on a larger scale.				
Nuclear fuel should be used for power production.				

[3]

(ii) Why is the new power station more efficient?

Put a tick (✓) in the box next to the BEST answer.

Less electricity is made.

A larger mass of coal is burned each day.

More electricity is made for each tonne of coal.

It burns more coal for each unit of electricity made.

It prevents polluting gases from reaching the air.

[1]

(c) Burning coal in power stations produces sulfur dioxide, a polluting gas.

It is possible to reduce this pollution.

One way of doing this is to use less electricity so that we need to burn less coal.

Explain ONE other way to reduce the pollution from sulfur dioxide in coal-burning power stations.

[2]

[Total: 8]

5 Kate takes her car for its MOT test.

At the garage, Mike measures the amount of polluting gases in the exhaust of the car.

The car only passes the test if these gases are below a set value.

(a) Mike checks the carbon monoxide released, in parts per million (ppm).

He uses an electronic detector.

He tests the car 5 times.

Here are the results for Kate's car.

TEST NUMBER	1	2	3	4	5
CARBON MONOXIDE IN PPM	125	202	205	206	203

(i) He says that the first result is an outlier and he will ignore it.

Why does he think it is an outlier?

Put a tick (✓) in the box next to the correct answer.

It was the first test.

It makes the other tests fair.

It is very different from the other values.

It is a lower result than the other values.

[1]

(ii) What is the range of the other four results?

range _____ to _____ [1]

(iii) What is the mean of the other four results?

Put a **ring** around the correct answer.

202

203

204

205

206

[1]

(b) When Mike tests a car exhaust, he always uses the same engine temperature and speed.

Why does he do this?

Put a tick (✓) in the box next to the BEST answer.

so he can calculate the mean temperature and speed

because these factors affect how noisy the engine is

so outliers can be clearly seen

because these factors change the amount of carbon monoxide made by the engine

[1]

(c) Mike repeats the test on a car that is the same make and model as Kate's car.

Here are the results.

TEST NUMBER	1	2	3	4	5	MEAN
CARBON MONOXIDE (PPM)	203	210	205	209	203	206

Is there a real difference between the test results for the two cars?

Explain your answer.

[2]

[Total: 6]

6 This question is about threats to life on Earth.

Asteroids collide with the Earth from time to time.

John worries about the risk of a large asteroid hitting the Earth.

Explain whether or not he should be worried.

Include in your answer

- the chance of a large asteroid colliding with the Earth
- the possible consequences of a large asteroid colliding with the Earth.

[4]

[Total: 4]

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7 Read the article about one of the moons of Saturn.

COULD THERE BE LIFE ON ENCELADUS?

Enceladus is a moon of Saturn.

In March 2008, the Cassini space probe flew close to Enceladus.

Instruments on Cassini detected a jet containing water, carbon dioxide, methane and more complex chemicals. They also detected lots of heat coming out of cracks on Enceladus. The heat means there could be liquid water under these cracks.

These results show that there may be life on Enceladus.

‘We see on Enceladus the three things you must have if there is to be life there,’ said one scientist. ‘There is water – although it may not be liquid – plus complex chemicals and heat.’

(a) Many scientists think that there may be life on planets around distant stars.

Looking for life on this moon of Saturn will be much easier than looking for life on a planet around a distant star.

Which two of the following statements, taken together, give an explanation for this?

Put ticks (✓) in the boxes next to the TWO correct answers.

Apart from the Sun, the nearest stars are more than 4 light years away.

Enceladus is a moon, not a planet.

Life forms on distant planets may not be anything like life on Earth.

Saturn is a giant planet consisting mostly of hydrogen and helium.

The fastest speed recorded for any space probe is under 70 km/s.

[1]

(b) Four space scientists are talking about the results from Cassini.

DOCTOR ROGERS said

'I saw this on the TV News.

Life may be quite common in the Universe. So far we only know of one place with life on it – the Earth!'

PROFESSOR CAMERON said

'I saw this on the internet, but I'm waiting until I've read about it in a scientific journal before I make my mind up.'

DOCTOR FRASER said

'I was in a conference last week. One of the Cassini scientists told us all about the complex chemicals given off from Enceladus.

It's quite possible that these chemicals have been produced by some form of life.'

DOCTOR JONES said

'I've not heard these results as I've been busy with my own research.

I don't expect there is anything in it.'

(i) Who says something about how scientists report their findings to other scientists?

Put a tick (✓) in EACH correct box.

Doctor Rogers

Professor Cameron

Doctor Fraser

Doctor Jones

[1]

(ii) Which scientist is talking about information which has been PEER REVIEWED?

Put a tick (✓) in the correct box.

Doctor Rogers

Professor Cameron

Doctor Fraser

Doctor Jones

[1]

(c) Space probes like Cassini have obtained lots of data and made many observations about Saturn and its moons.

Below are some statements of data and observations, and some possible explanations for the data.

Draw a straight line from each **STATEMENT** in the first column to its **BEST EXPLANATION** in the second column.

STATEMENT

The patterns in Saturn's atmosphere change very rapidly.

EXPLANATION

It has a dense, coloured atmosphere.

Saturn's moon, Phoebe, is different from the others. It is made of the same material as the distant dwarf planet, Pluto.

The winds in the atmosphere are very fast.

Saturn's moon, Titan, is actually smaller than it appears from Earth.

Small moons orbit Saturn and sweep up dust in their paths.

The rings of Saturn have gaps between them.

It may have come from a different part of the Solar System.

[3]

[Total: 6]

8 Read this article about the Geological Society of London.

In 1807, a group of scientists formed The Geological Society of London. They discussed the formation of land features such as mountains and valleys. Most people thought the Earth was about 6000 years old.

At this time, most scientists believed that changes to the Earth's surface were produced by sudden upheavals, including a great flood which covered the whole planet. This explanation is called 'catastrophism'.

Charles Lyell had a different explanation.

CHARLES LYELL said

'I've been in Sicily, studying the volcano Etna. It is made of many layers of volcanic rocks, so Etna did not form all in one go.

Underneath the volcanic rocks, there are rocks full of fossils of modern-looking animals and plants.

This makes me believe the Earth is very, very old. The rocks formed very gradually.'

(a) Members of the Geological Society did not believe Lyell.

Which of the following are SCIENTIFIC reasons for questioning Lyell's explanation?

Put a tick (✓) in EACH box next to a correct reason.

No other scientist had made similar observations.

Catastrophism explained many features of the rocks.

Lyell's suggestions showed too much imagination and creativity.

They believed that the Earth was too young to have produced gradual changes in rocks.

[2]

(b) The scientific community now agrees that Lyell was correct.

New evidence supports his explanation.

Here are some geological discoveries made since Lyell's time.

Put a tick (✓) in the box next to EACH discovery which supports Lyell's explanation.

Rocks on high mountains such as the Himalayas have fossils of sea animals in them.

Seafloor spreading moves continents about 10 cm further apart each year.

Some volcanoes are active today, while others which were active in the past are no longer active.

Rocks show that the Earth's magnetic field changes direction about every 250 000 years.

[2]

[Total: 4]

END OF QUESTION PAPER



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