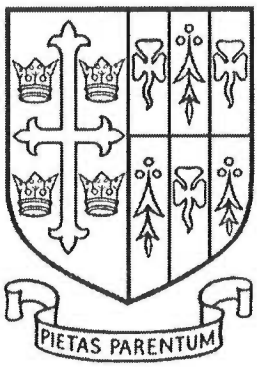
ST EDWARD'S
OXFORD



13+ SCHOLARSHIP EXAMINATION
2011

SCIENCE

Candidate Name

1 Hour 30 Minutes

INSTRUCTIONS TO CANDIDATES

Write your name in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.
A calculator may be used.

1. The table shows the percentage of some gases in the air a boy breathed in and out.

Gases	Air breathed in	Air breathed out
carbon dioxide	0.04%	4.0%
oxygen	20.0%	16.0%
water vapour	1.0%	6.0%

(a) What happens in the lungs to change the levels of oxygen and carbon dioxide in this way?

Oxygen .....

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.....

Carbon dioxide .....

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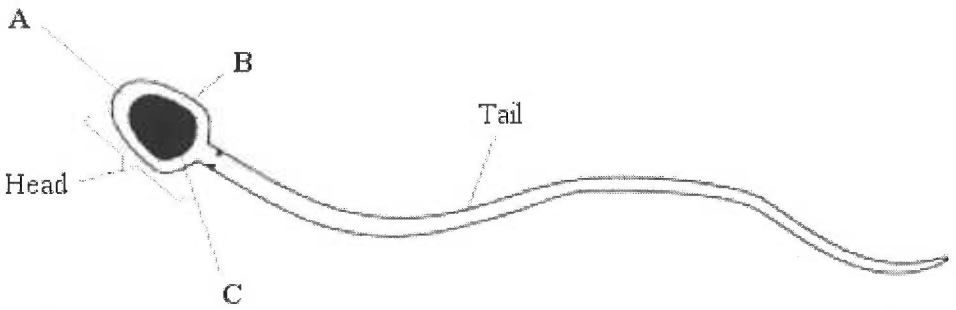
(4)

(b) Compare the percentage of water vapour in the air breathed out with the percentage in air breathed in.

.....

(2)
(Total 6 marks)

2. The diagram shows a sperm cell.



(a) Use words from the box to name parts **A**, **B** and **C**.

cell membrane	chloroplast	cytoplasm	nucleus	vacuole

A .....

B .....

C .....

(3)

(b) The sperm is a male gamete. It swims towards the female gamete.

Write down **two** ways in which the structure of the sperm helps it to swim.

1 .....

2 .....

(2)

(c) (i) What happens when a male gamete meets a female gamete?

.....

.....

(1)

(ii) What type of reproduction is this?

.....

(1)

(Total 7 marks)

3. In just a decade the population of the African elephant dropped from 1.3 million in 1979 to 625 000 in 1989. The ivory trade was a major cause of this. The international trade in ivory was banned in 1989 in an attempt to arrest the fall in elephant numbers. The ban does not, however, have universal support, particularly amongst African countries. The extracts below give some opinions about the ban on killing elephants.

Extract 1

Massive publicity for the plight of the elephant in the US and Europe resulted in people refusing to buy ivory products. As a result the world price of ivory fell. Poaching levels fell noticeably in five out of six countries studied since the introduction of the ban.

Extract 2

If the case for wildlife is justified on economic grounds alone, then protected areas could give way to many more profitable forms of land use. Wildlife, and especially an animal as intelligent as the elephant, has an absolute right to life and a value that cannot be measured solely in economic terms.

Extract 3

South African governments consider wildlife a natural resource which must earn its keep alongside other competing forms of land use both by bringing in tourists and from the killing of excess animals for food and other animal products. Zimbabwe for example keeps elephant numbers to a level which can be supported by the vegetation available. Before the ban, ivory and hide were exported to gain valuable foreign currency. The planned use of wildlife for the benefit of local people and as a means of conservation for elephants is of great importance in that country.

Extract 4

Banning the trade in ivory, these countries argue, removes one of the main economic justifications for giving over large areas of land to wildlife and has resulted in heavy financial losses for those countries which conserve elephants. These countries are asking that they should again be allowed to trade in ivory and hides to provide the funding to conserve elephants.

Extract 5

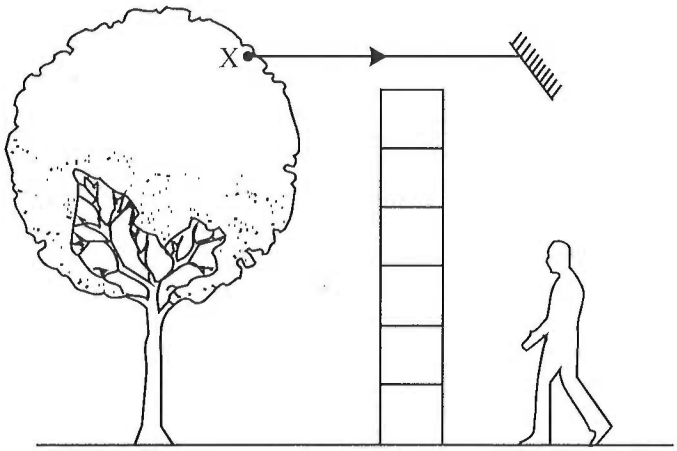
Arguments about the need to preserve elephants for their intelligence or for their appearance carry little weight in a rural population faced with widespread famine. In the long run it appears that African wildlife will have to benefit those who live alongside it, and pay its way if governments are to invest in it.

Read the extracts then state whether you think that the ban on ivory and hide trading should be lifted. Justify your decision by referring to all the extracts.

(Total 7 marks)

4. A man uses a periscope to see over a high wall.

The diagram shows one of the mirrors in the periscope.

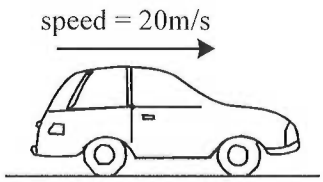


(a) Draw the other mirror in its correct position.

(b) Complete the light ray from point X on the tree to the man's eyes.

(Total 2 marks)

5. A car travels along a level road at 20 metres per second.



(a) Calculate the distance travelled by the car in 4 seconds.

(Show your working.)

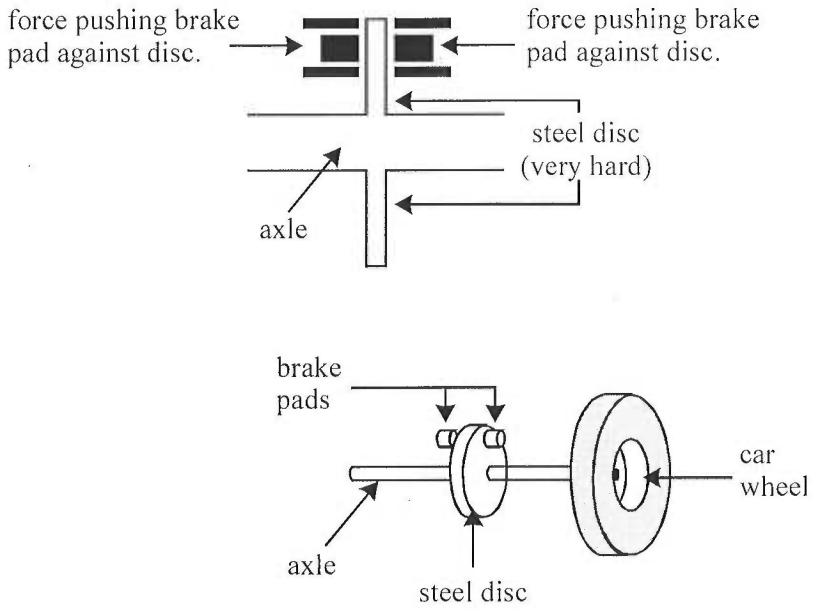
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(2)

(b) When the brake pedal of the car is pushed, brake pads press against very hard steel discs.



The force of friction between the brake pads and the steel discs gradually stops the car.

What **two** effects does using the brakes have on the **brake pads** and **wheel discs**?

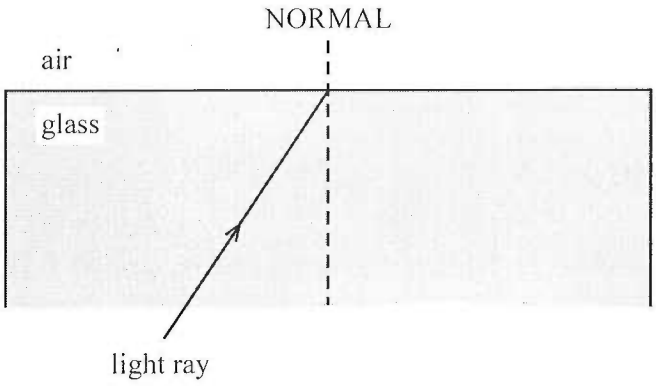
1 .....

2 .....

(2)

(Total 4 marks)

6. The diagram shows a ray of light travelling through a glass block.



(a) Complete the diagram to show what happens to the ray of light when it comes out of the glass.

(2)

(b) Explain why this happens to the ray of light.

.....

(1)
(Total 3 marks)

7. Frequency, wavelength and wave speed are linked by an equation:

Wave speed = Frequency x Wavelength

Calculate the speed of a sound wave with a frequency of 250 Hz and a wavelength of 1.3m.

Show how you get to your answer and give the unit.

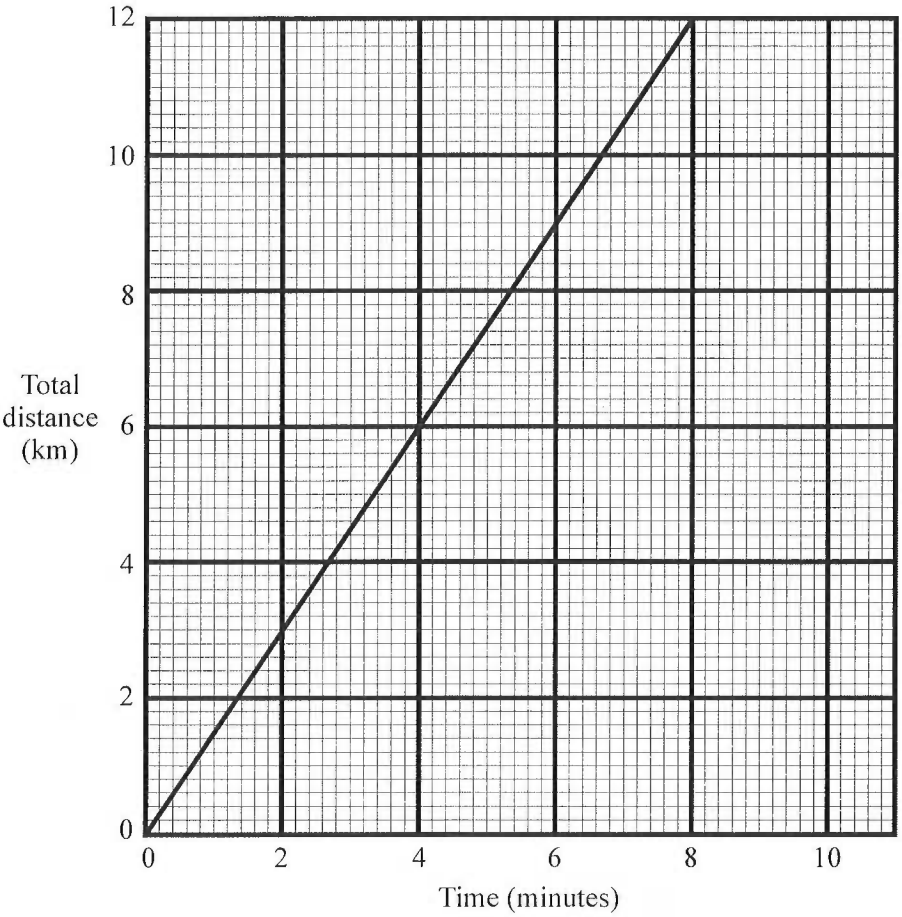
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Speed = ...

(2)
(Total 2 marks)

8. Below is a distance-time graph for part of a train journey.
The train is travelling at a constant speed.



(a) Use the graph to find

(i) how far the train travels in 2 minutes ..... km.

(ii) how long it takes the train to travel a distance of 10 kilometres ..... minutes.

(2)

(b) Calculate the speed of the train.

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(2)

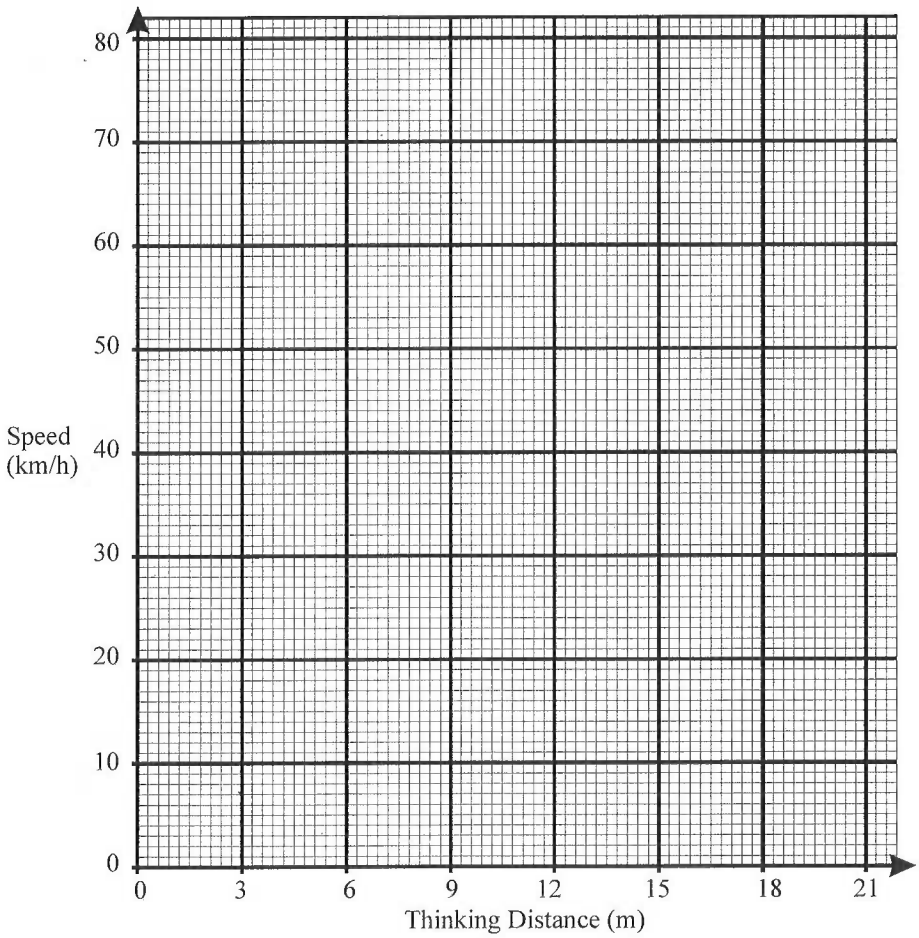
(Total 4 marks)

9. When a car driver has to react and apply the brakes quickly, the car travels some distance before stopping. Part of this distance is called the "thinking distance". This is how far the car travels while the driver reacts to a dangerous situation.

The table below shows the thinking distance (m) for various speeds (km/h).

Thinking distance (m)	0	9	12	15
Speed (km/h)	0	48	64	80

(a) On the graph paper below, draw a graph of the thinking distance against speed.



(3)

(b) Describe how thinking distance changes with speed.

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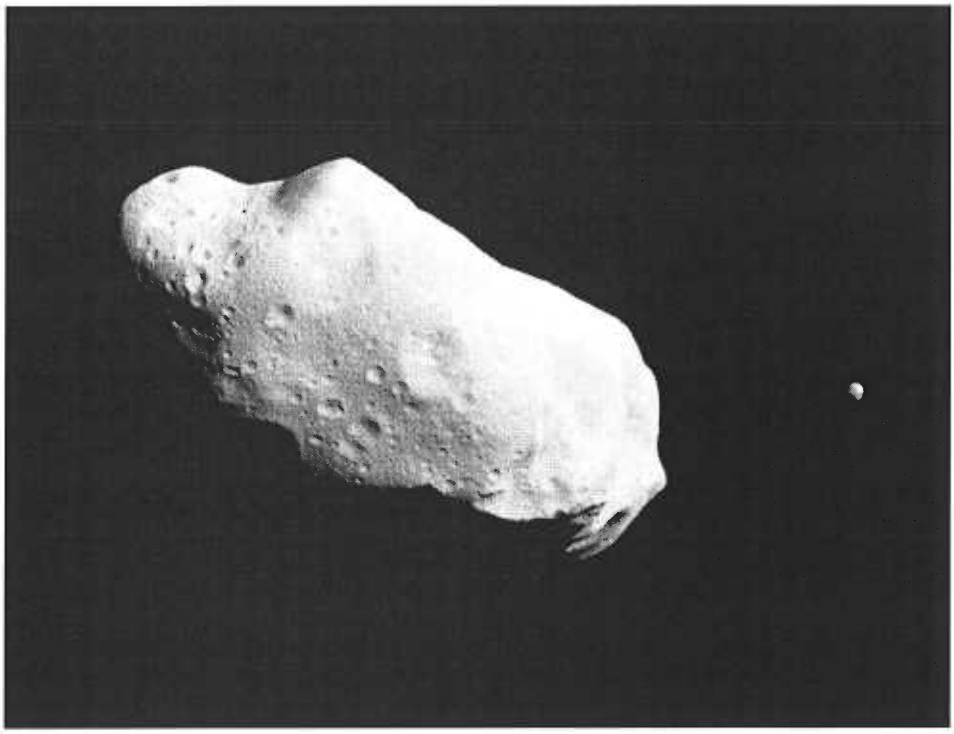
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(1)

(Total 4 marks)

10. Astronomers make nearly all conclusions from pictures from telescopes.

Below is an image of Asteroid called Ida and its tiny moon Dactyl.



List some scientific conclusions astronomers might make about Ida and Dactyl from this photo.

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(Total 3 marks + 2 bonus marks)

11. This question is about acid rain and the effect it can have on various materials. Read the following article (which comes from Young Peoples Trust for the Environment) before answering the questions that follow. Always explain your answers where possible.

What is Acid Rain?

Acid rain is a result of air pollution. When any type of fuel is burnt, lots of different chemicals are produced. The smoke that comes from a fire or the fumes that come out of a car exhaust don't just contain the sooty grey particles that you can see - they also contains lots of invisible gases that can be even more harmful to our environment.

Power stations, factories and cars all burn fuels and therefore they all produce polluting gases. Some of these gases (especially nitrogen oxides and sulfur dioxide) react with the tiny droplets of water in clouds to form sulfuric and nitric acids. The rain from these clouds then falls as very weak acid - which is why it is known as "acid rain". The release of sulfur dioxide can also occur naturally when a volcano erupts.

a. To be considered a fuel, what must a substance release when it is burnt? [1]

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b. Many of the fuels used in modern society are 'fossil fuels'.

i. How are these fuels formed?

[2]

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ii. Give an example of a fossil fuel.

[1]

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c. Nitrogen is a very unreactive gas and under normal conditions it does not react. Atmospheric nitrogen can react with atmospheric oxygen in either a lighting strike or in a car engine. Why?

[2]

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d. Many fossil fuels contain sulfur as an impurity.

i. Explain in as much detail as possible how the presence of the sulfur impurity leads to the formation of acid rain when a fossil fuel is burnt. [2]

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ii. In the above process the sulfur is considered to be oxidised. What do you think this might mean?

[1]

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e. The acid rain formed from oxides of nitrogen and oxides of sulfur in the atmosphere can attack various materials. Depending on the type of material they attack they can give off different gases.

i. Acids react with metals to give off a very light, flammable gas.
Complete the following equation:

[1]

Sulfuric + Iron → Iron + ...

acid sulfate

ii. Acids react with marble and limestone according to the equation below:

Sulfuric + Calcium → Calcium + Water + Carbon Dioxide

acid carbonate sulfate

What test would you carry out to confirm the identity of the gas produced above and what would be the result of that test? [2]

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f. The concentration of sulfuric acid in a sample of acid rain can be determined by finding what volume of the acid reacts exactly with a certain volume of sodium hydroxide, which is alkaline.

i. What type of reaction takes place between sulfuric acid and sodium hydroxide?

[1]

.....

ii. Using the apparatus below explain exactly how you would find out what volume of sodium hydroxide reacts **precisely** with $5cm^3$ of the acid rain sample. You need to be as accurate as you can be. [4]

Conical flask

$10cm^3$ measuring cylinder

White tile

Blue litmus solution

Acid rain sample

Sodium hydroxide sample

$10\ cm^3$ pipette with volume readings on it

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g. Acid rain corrodes limestone buildings.

Two samples of acid rain were collected and then reacted with similar pieces of limestone in the lab.

One of the acid rain samples was found to react more quickly.

Explain why this may have been the case and **suggest possible locations** from where the two samples may have been taken (e.g. a big town, the countryside, the seaside, any other sensible place), with your reasoning. [3]

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