BENENDEN

Lower School Scholarship 2019

SCIENCE

13+

1 Hour

Full Name: _____

Current school: _____

Date: _____

Instructions to Candidates:

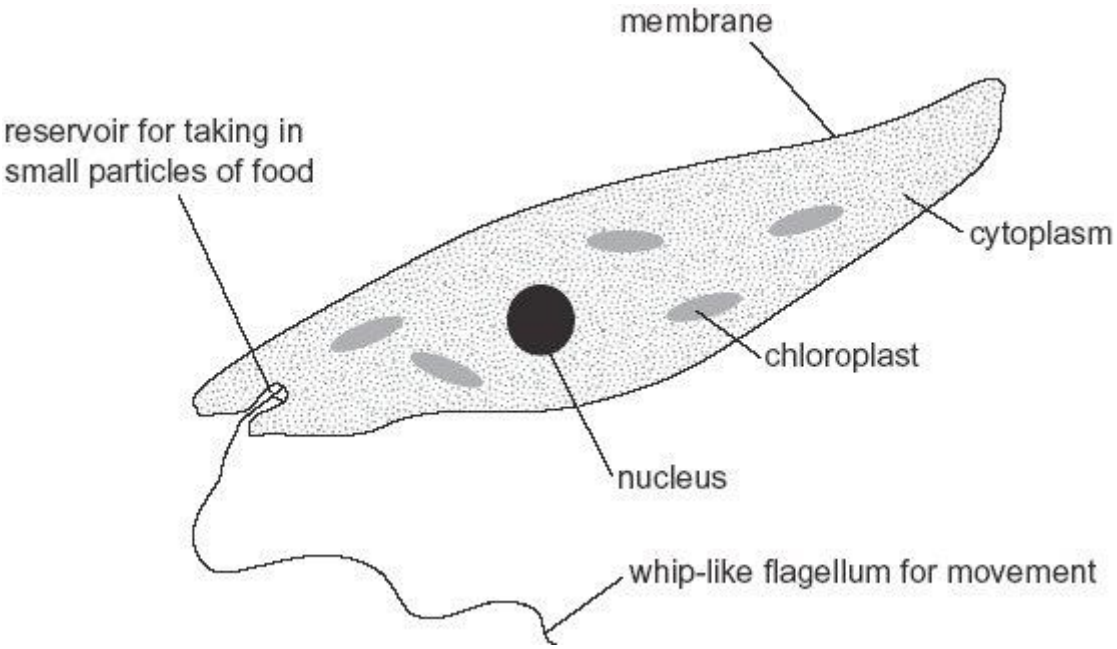
- Write your answers in the space provided in this booklet.
- (total mark of paper 100)
- There are questions that cover Biology, Chemistry and Physics topics, make sure you answer all of them
- Marks available are indicated in brackets

Equipment needed:

- Calculators are allowed
- Make sure you have ruler and a sharp pencil

Q1.

The diagram below shows an organism called Euglena.
It is made of only one cell. It lives in ponds and streams.
Euglena have features of both plants and animals.



(a) Look at the diagram of Euglena.

Give **two** pieces of evidence which suggest it is an **animal** cell and **not** a plant cell.

1. .....

1 mark

2. .....

1 mark

(b) Plant cells can carry out photosynthesis.
How can you tell from the diagram that Euglena can carry out photosynthesis?

.....

1 mark

(c) Complete the word equation for photosynthesis.

carbon dioxide + ... → glucose + ...

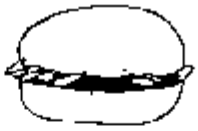
2 marks
maximum 5 marks

Q2.

The card shows the amounts of fat and fibre in some types of food and drink from a café.

Chez Jean Café

	fat in g	fibre in g
type of burger		
single burger	17	0.8
double burger	38	1.2
cheeseburger	21	1.0
type of drink		
strawberry milkshake	8	0
medium cola	0	0
medium orange juice	0	0
type of potato		
regular fries	15	3
baked potato	0	9









(a) From the card on the previous page, choose a meal consisting of a burger, a drink and some potato, to give:

(i) the least fat;

1 mark

(ii) the most fibre.

1 mark

Write your answers in the table below.

Food and drink	meal with the least fat	meal with the most fibre
type of burger		
type of drink		the drinks do **not** contain fibre
type of potato		

(b) Draw a line from each nutrient to the main reason why it is needed.
Draw only **four** lines.

nutrient		main reason why the nutrient is needed
		• to keep the intestine working properly
calcium	•	• for healthy teeth and bones
fibre	•	• for insulation
protein	•	• to provide energy
sugar	•	• for growth and repair

2 marks (1 mark per 2 correct statements)
Maximum 4 marks

Q3.

Matthew measured the pH of different soils.

(a) Tick **one** box in each row to show if each soil is acidic, neutral **or** alkaline.

soil	pH of soil	acidic	neutral	alkaline
A	4.5			
B	5.5			
C	6.3			
D	7.0			
E	7.8			

2 marks

(b) A hydrangea is a flowering plant. Matthew notices that the colour of hydrangea flowers is different for plants grown in different places.

He records the colour of the flowers on each plant.

His results are shown in the table below.



hydrangea flower

soil	pH of soil	colour of flowers			
		blue	violet	light pink	dark pink
A	4.5	✓			
B	5.5		✓		
C	6.3		✓		
D	7.0			✓	
E	7.8				✓

Look at Matthew's results.
Do his results support the statement that the colour of hydrangea flowers depends on pH?

yes ☐ no ☐

Explain your answer.

.....

.....

1 mark

(c) Matthew measured the pH of the soil near hydrangea plants found in different places.

Suggest one **other** variable Matthew could **not** control in his investigation.

.....

.....

1 mark

(d) Matthew wants to find out if the colour of blue hydrangea flowers depends on inherited factors **or** environmental factors.
The flowers were growing in soil of pH 4.5.
He plants them in soil of pH 6.3.

Complete the table below to show the colours of the new flowers in soil of **pH 6.3**

(i) if the colour is due to inheritance
(ii) if the colour is due to the environment

Use the table above to complete the table below.

	colour
starting colour of hydrangea flowers	blue
colour of new flowers if only due to inheritance	
colour of new flowers if only due to environment	

2 marks
maximum 6 marks

Q4.

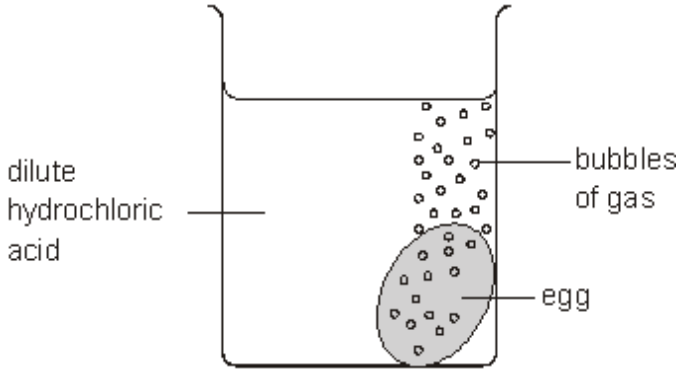
(a) The table below shows the pH of four acidic liquids.

acidic liquid	pH
grapefruit juice	3.1
ethanoic acid	3.0
lemonade	4.4
dilute hydrochloric acid	1.0

Which of these liquids is the **least** acidic?

1 mark

(b) Emilio cooked an egg until it was hard-boiled.
He put the egg in a beaker of dilute hydrochloric acid as shown.



(i) The egg shell reacted completely with the acid.
After two days the pH of the liquid in the beaker was 2.5.

How did the **acidity** of the liquid in the beaker change?
Use the table above to help you.

.....

1 mark

(ii) Emilio put another hard-boiled egg in some ethanoic acid.
It took longer for the shell to react completely.

Use the table opposite to suggest a reason for this.

.....

.....

1 mark

(c) The chemical formulae for four acids are shown in the table below.

sulphuric acid	**hydrochloric acid**	**nitric acid**	**ethanoic acid**
H_2SO_4	HCl	HNO_3	CH_3COOH

(i) Give the **name** of the element that is present in all four acids.

.....

1 mark

(ii) Give the **names** of the two **other** elements present in sulphuric acid.

1. .....

1 mark

2. .....

1 mark

(iii) How many atoms are there in the formula HNO_3 (nitric acid)?

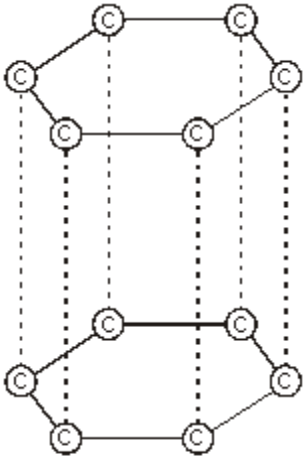
.....

1 mark

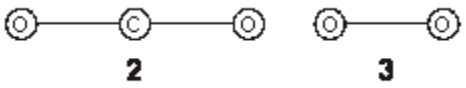
maximum 7 marks

Q5.

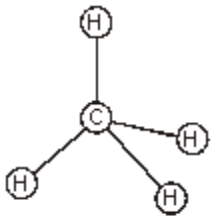
The diagrams represent the way 'atoms' are arranged in six chemical substances.
Each 'atom' is represented by a circle.
The 'atoms' are labelled with their chemical symbols.



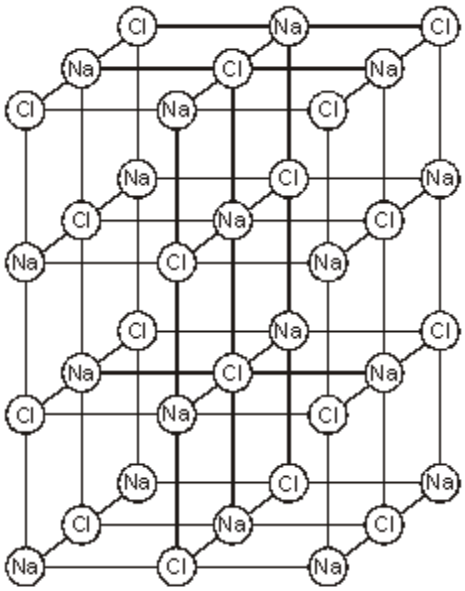
1



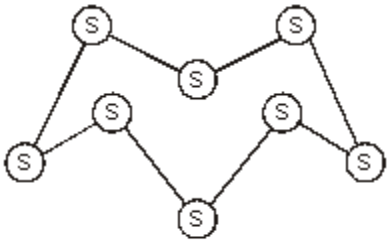
2 3



4



6



5

(a) (i) Which diagrams represent the structures of chemical elements?
Write the numbers.

.....

1 mark

(ii) Explain how you made your decision.

.....

.....

1 mark

(b) Give the formulae of **two** of the compounds represented in the diagrams.

1. .....

2. .....

2 marks

(c) Give the **name** of substance **6**.

.....

1 mark

(d) Give the names of the chemical elements whose atoms can be represented by the following symbols.

C .....

Cl .....

Cu .....

3 marks

Maximum 8 marks

Q6.

An alloy is a mixture of elements.
The table shows the mass of each element present in 100 g of five different alloys,
bronze, solder, steel, stainless steel and **brass.**

alloy	mass of each element in 100 g of alloy							
	lead (g)	**tin (g)**	**copper (g)**	**zinc (g)**	**carbon (g)**	**iron (g)**	**chromium (g)**	**nickel (g)**
bronze		4	95	1				
solder	62	38						
steel					1	99		
stainless steel						70	20	10
brass			67	33				

(a) Which **alloy** in the table above contains an element which is a non-metal?

.....

1 mark

(b) Which **two alloys** in the table contain only **two metals**?

..... and

..... 1 mark

(c) Another alloy called nichrome contains only the elements chromium and nickel.
100 g of nichrome contains 20 g of chromium.

How much nickel does it contain?

…… g

1 mark

(d) Before 1992, two-pence coins were made of bronze.
Steel rusts but bronze does **not** rust.

(i) Why does bronze **not** rust?
Use information in the table above to help you.

.....

.....

1 mark

(ii) Rusting requires water and a gas from the air.
Give the name of this gas.

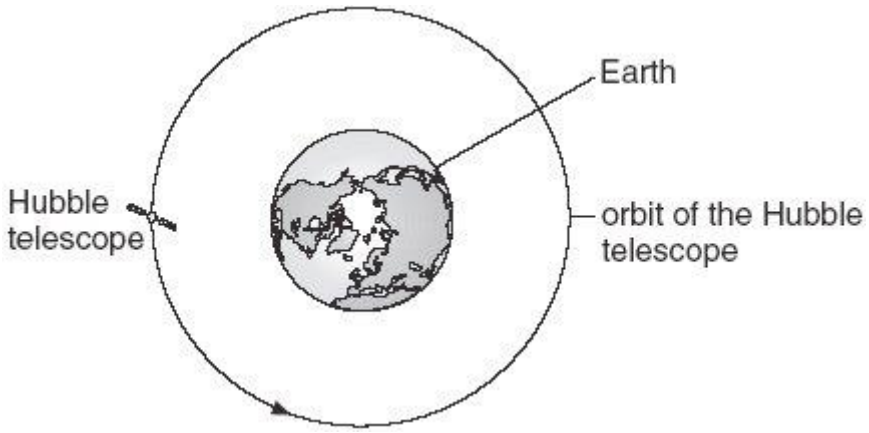
.....

1 mark

maximum 5 marks

Q7.

The diagram below shows the Hubble telescope in orbit around the Earth.



not to scale

(a) Which force keeps the telescope in orbit around the Earth?
Tick the correct box.

air resistance	☐	friction	☐
gravity	☐	magnetism	☐

1 mark

(b) The Hubble telescope is a satellite used for looking at planets and stars.

Give **one** other use of satellites.

.....

.....

1 mark

(c) Fill each of the gaps in the following sentences with a different word from the box
below.

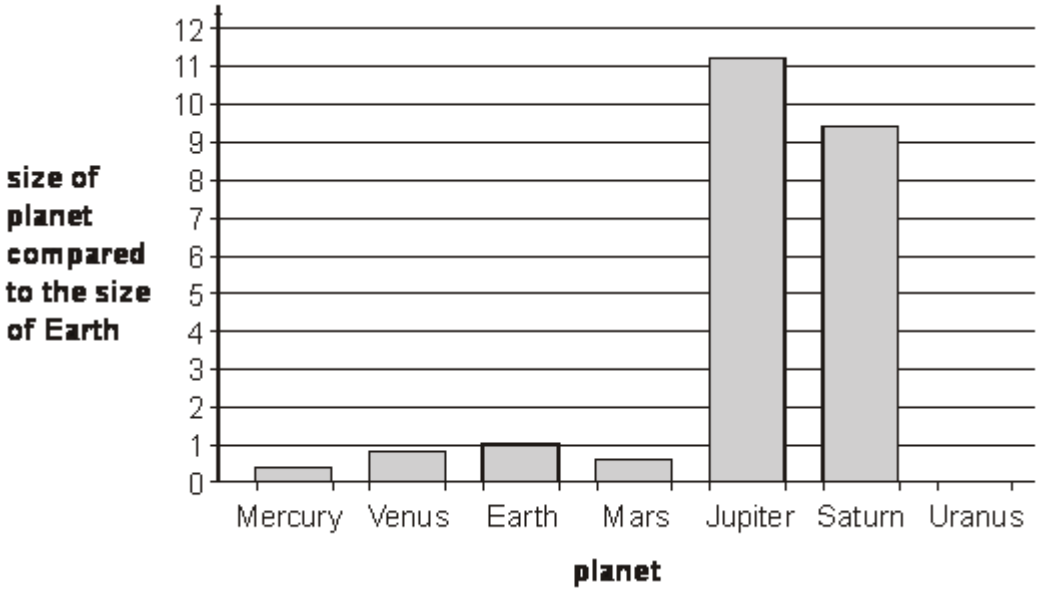
absorbs	**produces**	**reflects**

You can see the Sun because it ..... light.

You can see a satellite because it ..... light.

1 mark

(d) The bar chart shows the size of five planets compared to the size of Earth.



The planet Uranus is four times the size of Earth.
On the chart above, draw a bar for the planet Uranus.

1 mark

(e) (i) Arrange the following in order of size, starting with the smallest.

Sun	**Hubble telescope**	**Earth**

....
smallest **largest**

1 mark

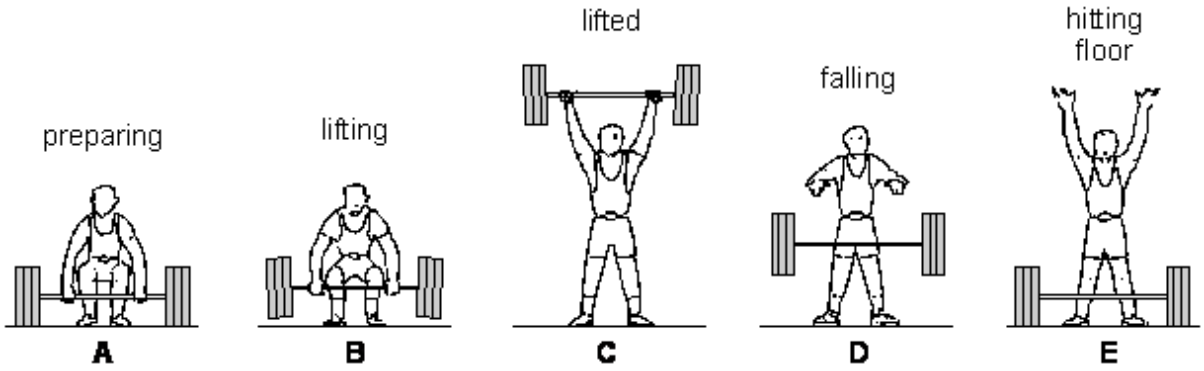
(ii) Some stars are bigger than the Sun but they look smaller.
Why do they look smaller than the Sun?
Tick the correct box.

They are brighter than the Sun.	☐	They are the same colour as the Sun.	☐
They are further away than the Sun.	☐	They are nearer than the Sun.	☐

1 mark
maximum 6 marks

Q8.

The drawings show a weightlifter. The stages in weightlifting are labelled A, B, C, D and E.



(a) (i) Complete the sentences below.

As the weights were lifted up, energy was transferred from the man to the weights. This energy had been stored as …… energy in the …… of the man's arms.

2 marks

(ii) How was energy stored in the weights at stage C?

Tick the correct box.

as chemical energy	☐	as elastic energy	☐
as kinetic energy	☐	as gravitational potential energy	☐

1 mark

(b) Complete the sentences below.

(i) In stage D, as the weights were falling, the energy was transferred from …… energy to…… energy.

1 mark

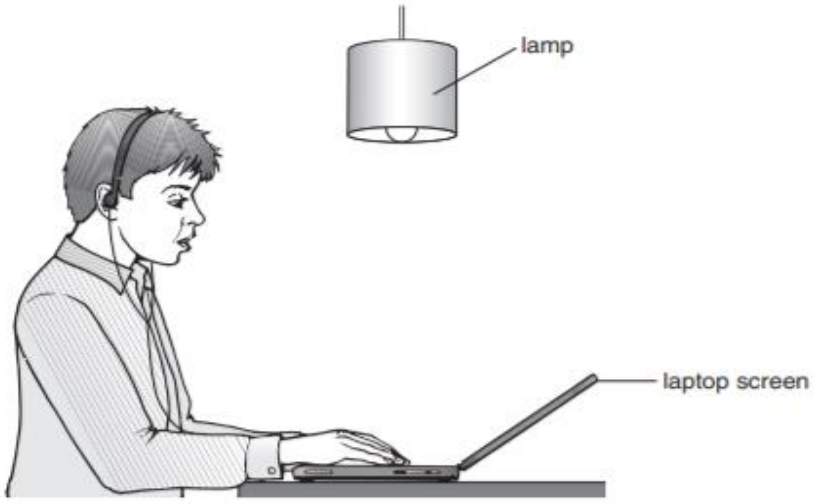
(ii) In stage E, as the weights hit the floor, the energy was transferred from …… energy to …… energy.

1 mark

Maximum 5 marks

Q9.

(a) The diagram below shows George using his laptop.
Light from the lamp is reflected by the laptop screen.

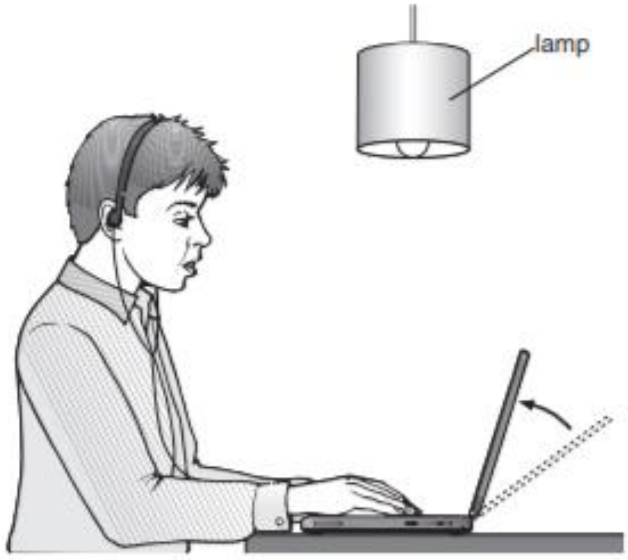


(i) **On the diagram above** draw a ray of light to show how George sees the light from the lamp reflected by the laptop screen. Use a ruler.

Draw arrows to show the direction of light.

2 marks

(ii) With the laptop screen in the position shown in part a(i), George sees an image of the lamp on the screen.
George tilts the screen forwards as shown below.



When the screen is tilted forwards it is easier for George to see the words on the screen.
What happens to the reflected ray of light when the screen is tilted?

1 mark

_____

_____

(b) George listens to music on his headphones.

Complete the sentence below using words from the box.

chemical	**electrical**	**gravitational potential**
sound	**thermal**	

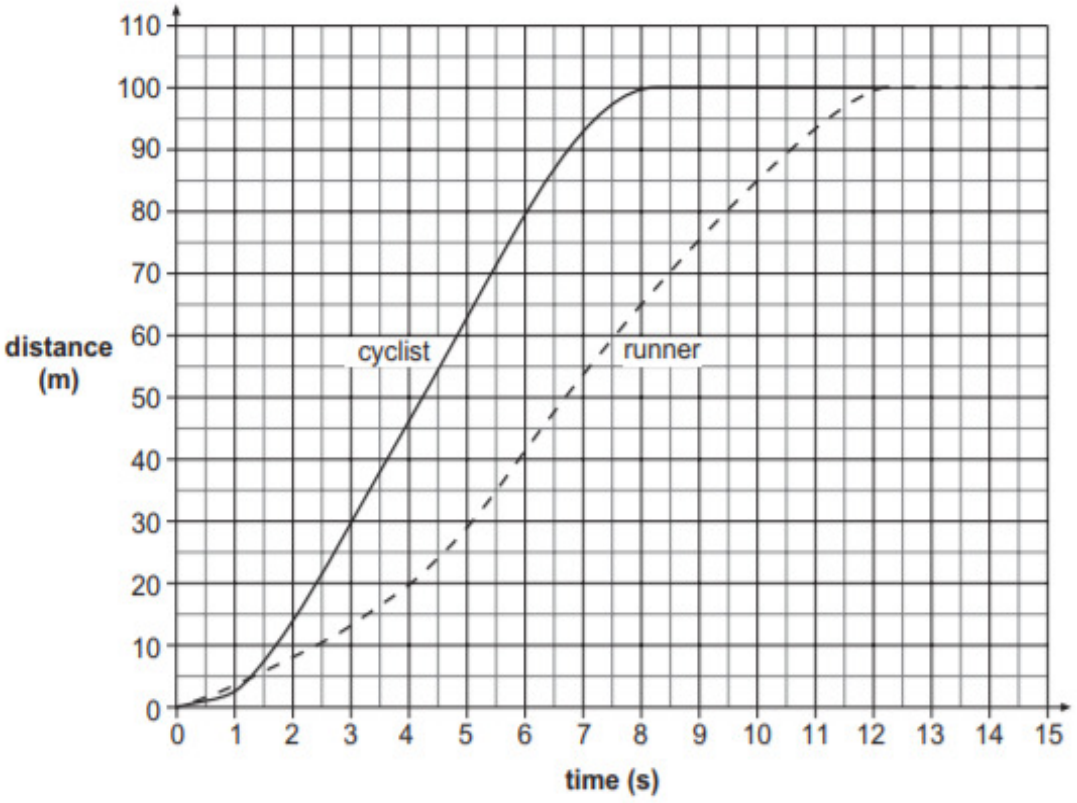
The useful energy change in the headphones is from _____ 1 mark

energy into _____ energy.

Maximum 4 marks

Q10.

A cyclist and a runner have a race.
The distance-time graph for the race is shown below.



Use the graph to answer the following questions.

(a) (i) How much time did it take the cyclist to travel 100 m?

1 mark

_____ s

(ii) When the cyclist finished the race how far behind was the runner?

1 mark

_____ m

(iii) How much more time did the runner take compared with the cyclist to complete the race?

1 mark

_____ s

(b) The cyclist is travelling at a constant speed between 3 seconds and 6 seconds.

How does the graph show this?

_____ 1 mark

_____

(c) (i) When the race started, a walker set off at a steady speed of 2 m/s.

Draw a line on the graph on the opposite page to show the distance covered by the walker in the first 15 seconds. Use a ruler. 1 mark

(ii) Calculate how much time it will take for the walker to walk 100 m.

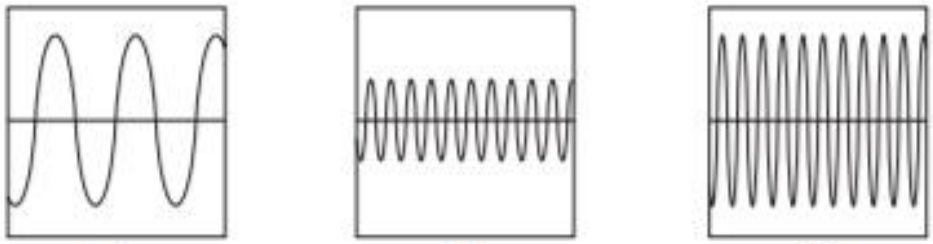
_____ 1 mark

_____ s

maximum 6 marks

Q11.

(a) The diagrams below show the patterns produced on an oscilloscope by three different sound waves.



(i) Which **two** waves have the same loudness?
Write the letters.

_____ and _____

How do the diagrams show this?

_____

_____

1 mark

(ii) Which **two** waves have the same pitch?
Write the letters.

_____ and _____

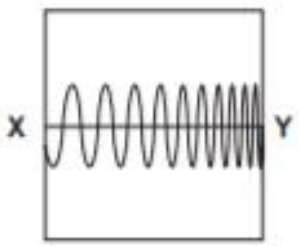
How do the diagrams show this?

_____

_____

1 mark

(iii) Shuli is listening to a sound that produces the pattern below.



Describe how the sound that Shuli **hears** changes between X and Y.

_____

1 mark

(b) The table below shows the maximum time a person can listen to music at different sound levels without damage to the ear.

sound level (decibels)	maximum time (hours)
86	8
88	4
90	2
92	1
94	0.5

Estimate the maximum time a person could listen to a sound of 87 decibels.

_____ hours

1 mark

(c) The diagram below shows part of the human ear.



What happens to the ear drum as a sound gets louder?

1 mark

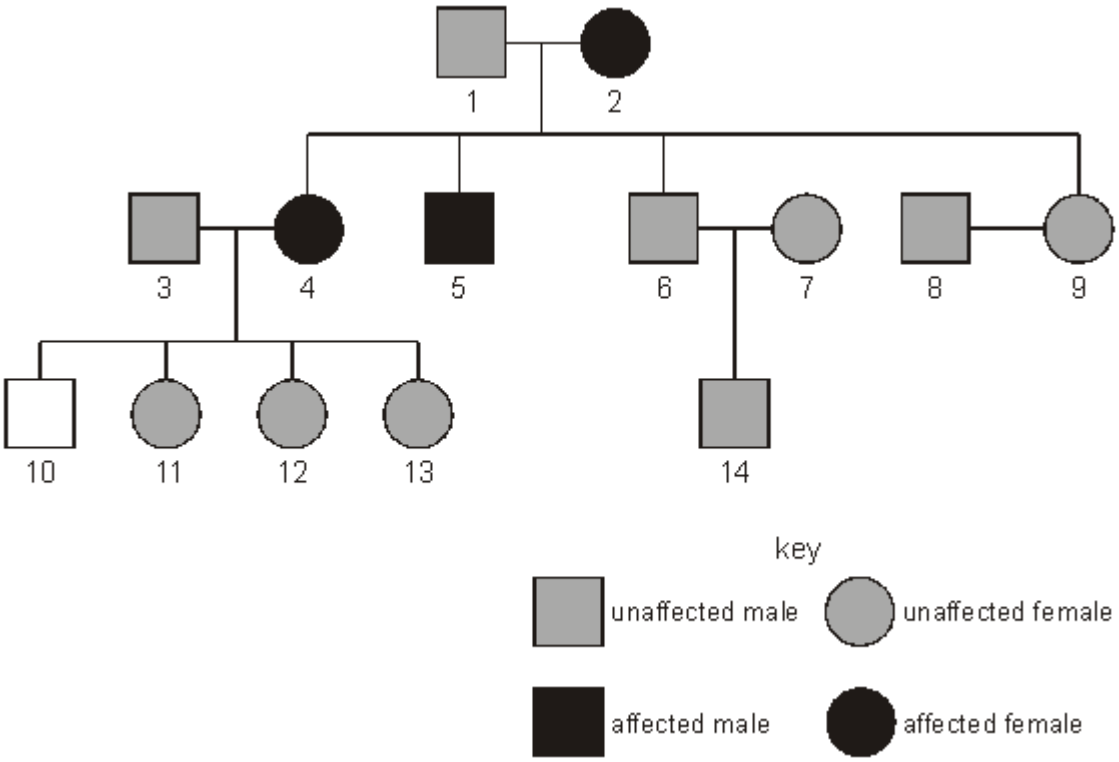
_____

_____

maximum 5 marks

Q12.

The diagram shows a family tree in which some members of the family had a hereditary disease. The disease is caused by a dominant allele.



(a) In the questions below, use **G** to represent the dominant allele for the disease, and **g** to represent the normal allele.

(i) Give the genotype of the grandmother, person 2.

.....

1 mark

(ii) Explain how you arrived at your answer.

.....

.....

.....

.....

2 marks

(b) (i) Give the genotype of person 5.

.....

1 mark

(ii) Explain how you arrived at your answer.

.....

.....

1 mark

(c) Person 10 died soon after birth. What is the possibility that he would have developed the disease if he had survived?

.....

1 mark

(d) Harmful alleles like allele **G** arise because of mutation.

(i) Explain what is meant by mutation.

.....

.....

1 mark

(ii) State **one** cause of mutation.

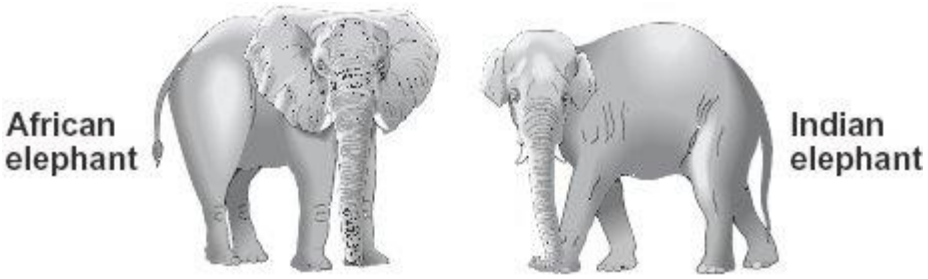
.....

1 mark

Maximum 8 marks

Q13.

(a) Elephants keep cool by losing heat from their ears.



Predict which elephant can lose more heat from its ears.

..... elephant

Give the reason for your answer.

.....

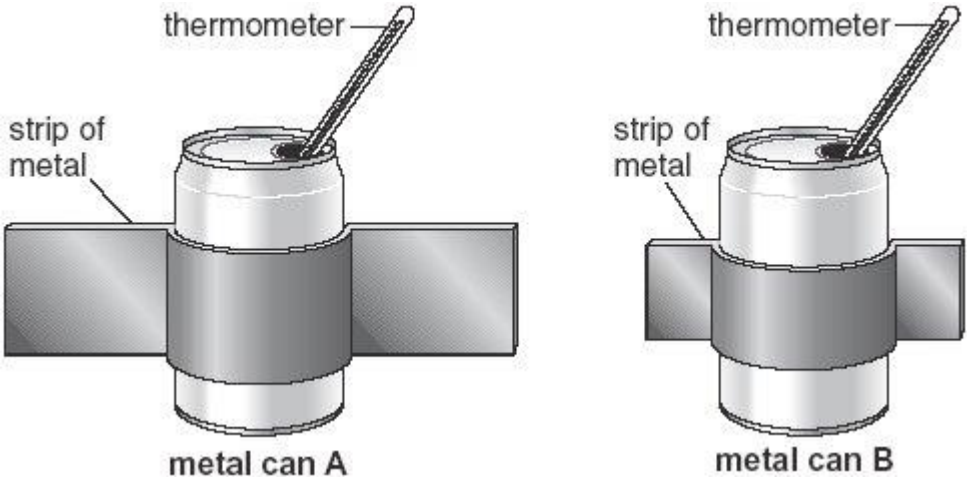
.

.....

.

1 mark

(b) Ben filled two identical cans with 250 cm^3 of hot water.
He wrapped strips of metal around them to model the elephants' ears.



He recorded the temperature of the water in each can every 5 minutes.
The table shows his results.

time (minutes)	temperature (°C)	
	can A	can B
0	60	60
5	54	57
10	50	54
15	46	52
20	43	50

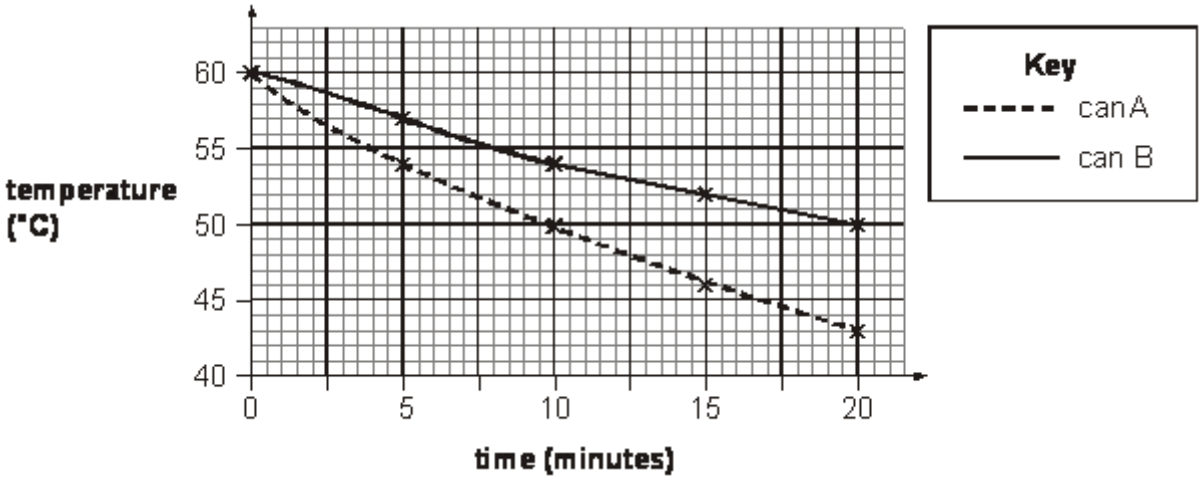
(i) Ben started with water at the same temperature in both cans.
Give **one** other way he made his test fair.

.....

.....

1 mark

(ii) He plotted the results for **can A** and **can B** and drew lines of best fit.



Why is it more useful to present these results in a graph rather than a table?

.....

.....

1 mark

(iii) The water in **can A** cooled more quickly than the water in **can B**.
Does this support your prediction in part (a)?
Tick the correct box.

yes ☐ no ☐

Explain your answer.

.....

.....

1 mark

(c) Ben repeated the investigation. Instead of a thermometer he used a temperature sensor and a data logger.
Give **one** advantage of this.

.....

.....

1 mark

maximum 5 marks

Q14.

Part of the reactivity series of metals is shown below.

most reactive	potassium
	sodium
	magnesium
	aluminium
	iron
	lead
least reactive	copper

(a) Dan added a piece of magnesium to a solution of copper sulphate.
A displacement reaction took place.

The word equation for the reaction is shown below.

magnesium + copper sulphate → magnesium sulphate + copper

Why is this called a displacement reaction?

.....

.....

1 mark

(b) Look at each pair of chemicals in the table below.

Use the reactivity series to predict whether a displacement reaction would take
place.
Write **yes** or **no** in the second column and give the reason for your decision.

pairs of chemicals	**Does a displacement reaction take place? yes or no**	**reason**
iron + sodium chloride		
magnesium + lead nitrate		

2 marks

(c) Dan wanted to find out where zinc should be placed in the reactivity series.

(i) What tests should Dan do to find the correct position of zinc in the reactivity series?

.....

.....

.....

1 mark

(ii) How would Dan use his test results to decide where to put zinc in the reactivity series?

.....

.....

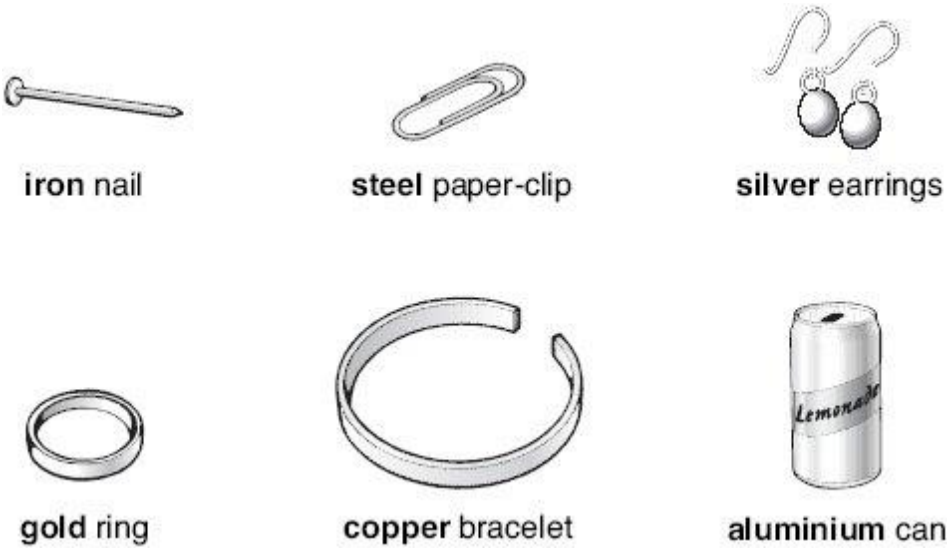
.....

1 mark

maximum 5 marks

Q15.

The drawings show six objects made from different materials.



not to scale

(a) Fill the gaps in the sentences below.

The objects are made from materials that are all types of .....

1 mark

All the materials are good conductors of electricity and .....

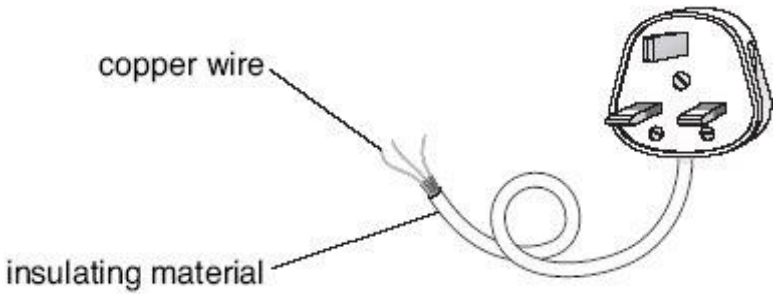
1 mark

(b) From the drawings above give **one** object that could rust.

.....

1 mark

(c) The drawing below shows part of an electric cable and a plug.



(i) What material could be put around the wires to insulate them?

.....

1 mark

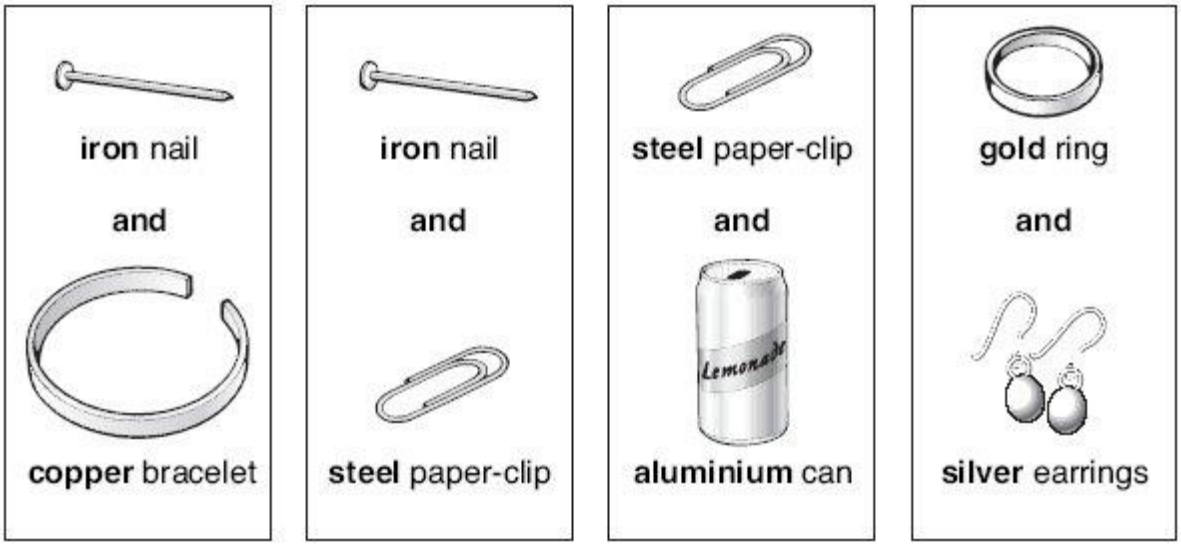
(ii) Why is this insulating material needed?

.....

.....

1 mark

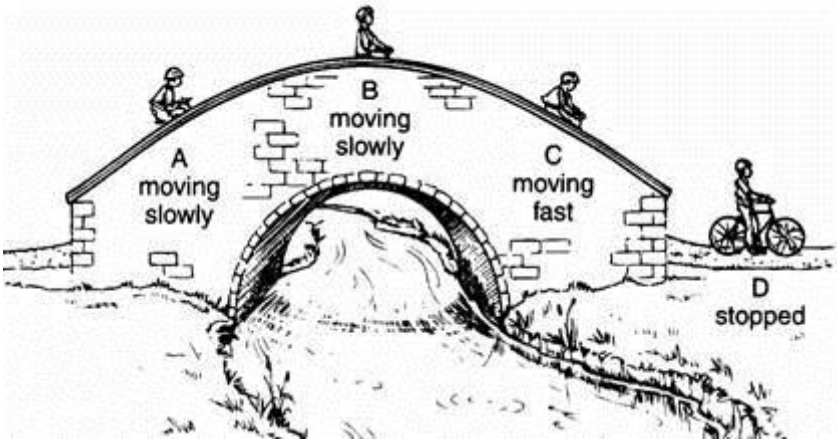
(d) Which pair of objects is attracted to a magnet?
Tick the correct box.



1 mark
maximum 6 marks

Q16.

The diagram shows a cyclist at different positions as he cycles over a humpback bridge.



(a) (i) Where does the cyclist have the most kinetic energy?
Tick the correct box.

A ☐ B ☐ C ☐ D ☐

1 mark

(ii) Where does the cyclist have the most potential energy?
Tick the correct box.

A ☐ B ☐ C ☐ D ☐

1 mark

(iii) Where does the cyclist have the least potential energy?
Tick the correct box.

A ☐ B ☐ C ☐ D ☐

1 mark

(b) The cyclist used some energy to cycle over the bridge. Where was this energy transferred to by the time the cyclist reached position **D**?

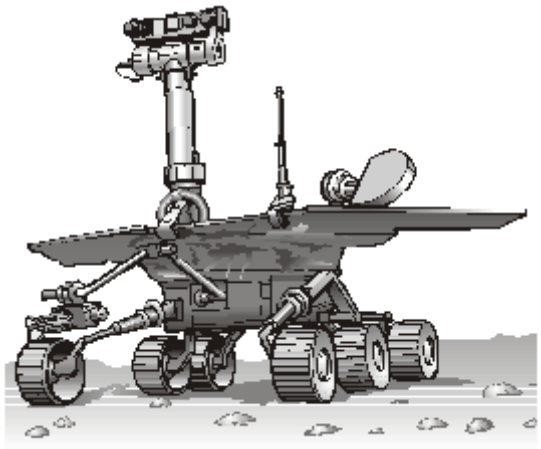
.....

1 mark

Maximum 4 marks

Q17.

The drawing below shows a space buggy on the surface of Mars.



(a) The distance between Earth and Mars is 192 000 000 km.

It took a spacecraft 200 days to take the buggy from Earth to Mars.

Calculate the speed at which the spacecraft travelled.

Give the unit.

.....

.....

2 marks

(b) The weight of the buggy was 105 N on Earth and 40 N on Mars.

Why was the weight of the buggy less on Mars than on Earth?

.....

.....

1 mark

(c) The buggy uses solar panels to generate electrical energy.

The solar panels generate less electrical energy on Mars than on Earth.

Give a reason why.

.....

.....

1 mark

(d) The weight of the buggy was 40 N on Mars.
When the buggy landed on Mars it rested on an area of 0.025 m^2.

Calculate the pressure exerted by the buggy on the surface of Mars.

Give the unit.

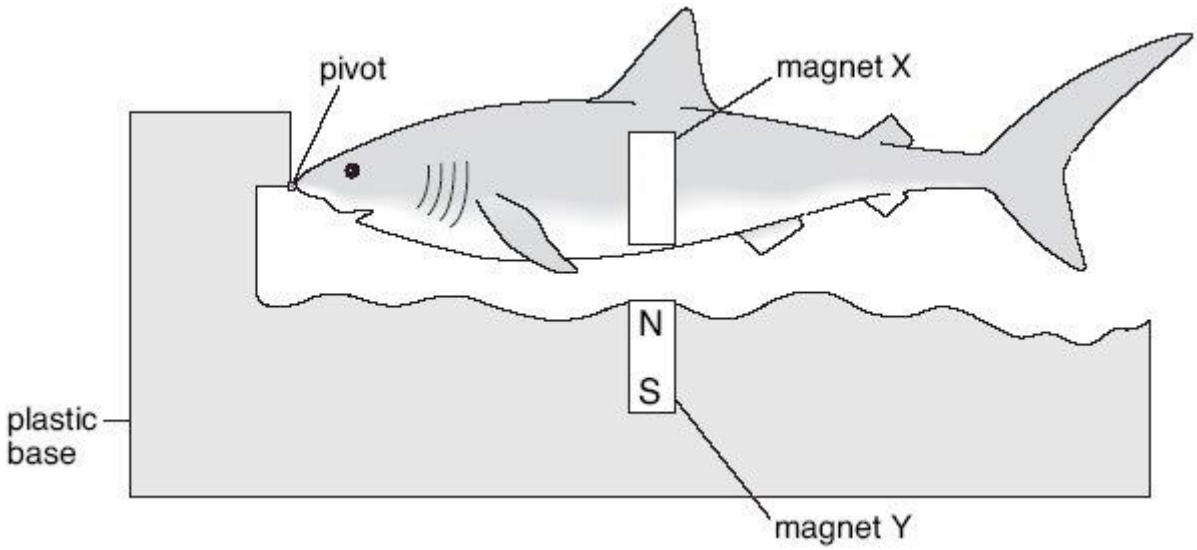
.....
..

.....
..

2 marks
maximum 6 marks

Q18.

The drawing shows a toy shark. Magnets X and Y make the shark 'float' above the plastic base.



(a) On magnet X, write the letters N and S to label the poles of the magnet.

1 mark

(b) (i) Choose a word from the list below to complete the sentence.

attract **cancel** **repel**

The toy shark 'floats' because the magnets ..... each other.

1 mark

(ii) Sophie pressed down on the tail of the shark with her finger.

What happened to the shark when she removed her finger?

.....

1 mark

(c) Sophie added weights to the toy shark and measured the distance between the
two magnets.
Her results are shown below.

weight added to the toy shark (N)	distance between the magnets (mm)
0.1	6
0.2	4
0.3	3

Complete the sentence below.

As the weight on the toy shark increased, the distance between the magnets
.....

1 mark

(d) Sophie turned the magnet in the plastic base the other way up.

What happened to the shark?

.....

1 mark
maximum 5 marks

END OF TEST