BENENDEN

Lower School Scholarship 2018

(Science)

13+

1 Hour

Full Name: _____

Current school: _____

Date: _____

Instructions to Candidates:

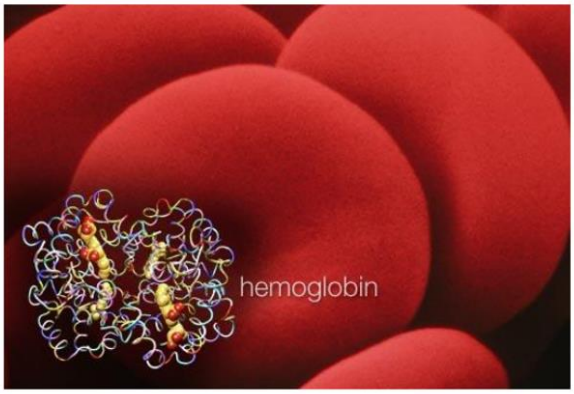
- Write your answers in the space provided in this booklet.
- (total mark of paper 100)
- There are questions that cover Biology, Chemistry and Physics topics, make sure you answer all of them
- Marks available are indicated in brackets

Equipment needed:

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

QUESTIONS ON BIOLOGY

Q1. The picture below shows red blood cells. Red blood cells contain a protein called Haemoglobin which helps them transport oxygen.
Micrometres (µm) are a unit of measurement. There are 1000µm in a millimetre (mm).



(a) The diameter of the red blood cells in the image is 0.85mm. What is their diameter in µm? Make sure you show your working.

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…… 2 marks

(b) The protein haemoglobin contains a metal atom. What metal is it and name a source of food that contains a large amount of it?

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…… 2 marks

(c) A pin head is 1.6mm. How many red blood cells can fit across it? Show your working.

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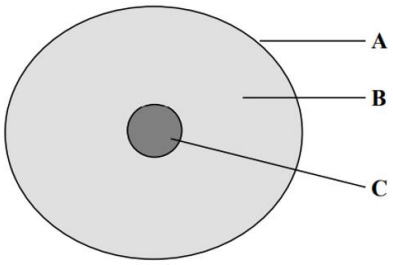
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…… 2 marks

Maximum 6 marks

Q2. The diagram shows a cell from the testes of an animal.



(a) Name the parts of the cell labelled A, B and C.

A: ……

B: ……

C: …… 3 marks

(b) Which part of the cell contains the chromosomes?

…… 1 mark

(c) The cell diagram will develop into a male gamete.
In plants, what name is given to the male and female gametes?

Male plant gamete: ……..

Female plant gamete: …… 2 marks

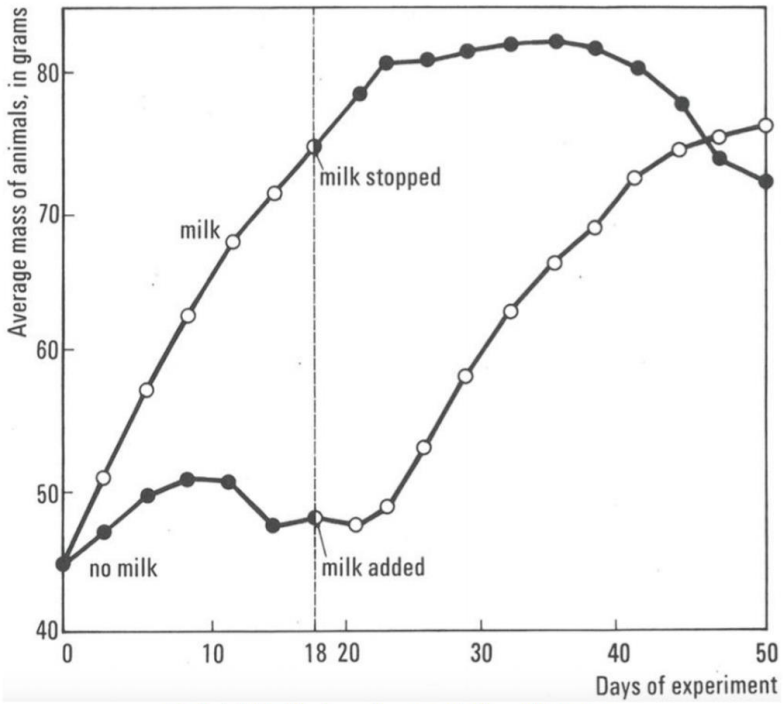
Maximum 6 marks

Q3. The idea that a disease could be caused by a lack of an essential substance in food occurred to a few people in the past but few tried to do carefully controlled experiments to test their ideas.

One scientist, Magendie, fed dogs a diet of sugar, butter, gelatine (a protein) and distilled water. The dogs all died within 30 to 36 days.

Frederick Hopkins fed rats on purified milk protein, starch, sugar, lard and salts. The rats did not grow and soon died but adding 3cm of milk to the diet caused the rats to grow normally.

The results of one of his experiments are shown below.



Frederick Hopkins' experiment on feeding milk to rats.

(a) What does Frederick Hopkins experiment on rats tell us that the experiment on dogs did not?

……..

…… 1 mark

(b) Suggest one other way in which the rat experiment is better than the dog experiment?

……..

…… 1 mark

(c) Can you suggest a reason why the young rats without milk grew a little during the first few days of the experiment?

……

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……

…… 2 marks

(d) Hopkins studied the average mass of the rats, suggest two other measurements or observations that might be taken as a record of normal growth?

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…… 2 marks

(e) Why do you think Hopkins chose mass?

……

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……

…… 2 marks

(f) What name do we use for these essential dietary components?

…… 1 mark

(g) Give the name of any deficiency disease caused by the lack of one of these essential dietary components.

…… 1 mark

Maximum 10 marks

Q4. **(i)** What is the name of the process which takes place in living cells in your body and which releases energy from oxygen and glucose?

…… 1 mark

(ii) Name the two products of the process in part (i).

…….. and ……. 1 mark

Maximum 2 mark

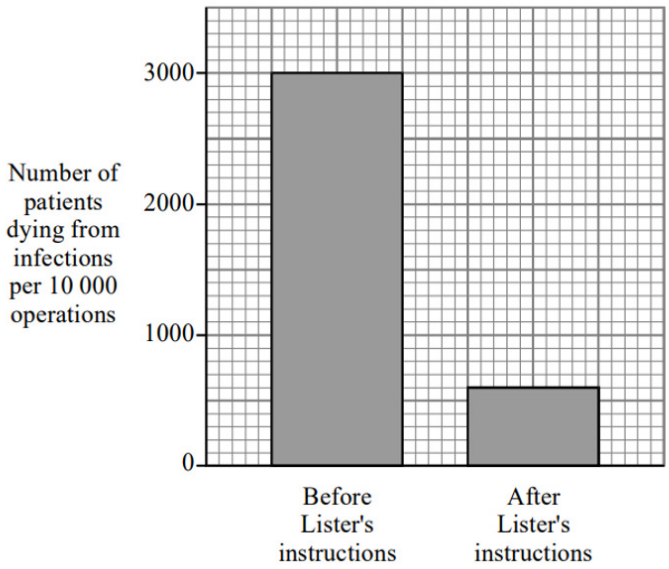
Q5. In the eighteenth century, surgeons did not wear special clothing or wash their hands before operations. Many of their patients died from infections.

(a) Suggest why patients died from infections after operations.

…… 1 mark

(b) In the nineteenth century, Joseph Lister told surgeons to use sprays of carbolic acid in operating theatres and to wash their hands.

The graph shows the effect that using Listers instructions had had on the number of patients who died from infections after surgery.



Describe how Lister's instructions affected the number of patients dying from infections after surgery.

……

……

……

……. 2 marks

Maximum 3 marks

Q6. The table compares some features of a polar bear and the Malayan sun bear. The polar bear lives in the Arctic where the climate is cold. The Malayan sun bear lives in warm tropical forests.

	Polar bear	**Malayan sun bear**
Colour of fur	White	Black
Thickness of fur in cm	5	2
Thickness of fat layer under skin in cm	11	1
Surface area compared to body size	Low	High

Use information from the table to explain how the polar bear is better than the Malayan sun bear for survival in arctic conditions.

To gain full marks in this question you should write your ideas in good English. Put them into sensible order and use the correct scientific words.

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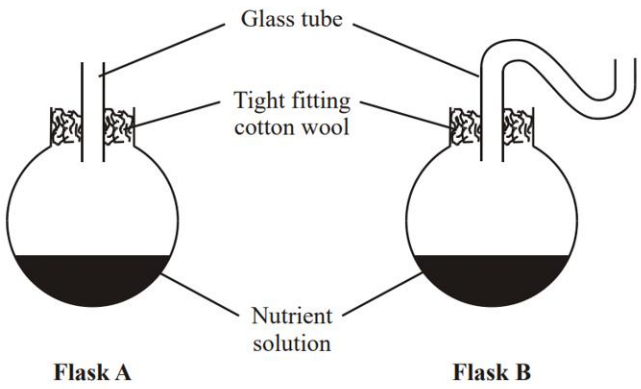
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……. 5 marks

Maximum 5 marks

Q7. In the 1800s, Louis Pasteur investigated the reasons why food goes rotten.
To check one of Pasteur`s experiments, a student set up the two flasks shown in the diagram.



After three days the nutrient solution in both flasks had gone rotten.

(a) What makes the nutrient solution go rotten?

…… 1 mark

(b) The student then set up two more similar flasks. This time, she boiled the nutrient solution in both flasks for ten minutes.

(i) Why did she boil the nutrient solution?

…… 1 mark

(ii) Why did the nutrient solution in flask A go rotten?

…… 1 mark

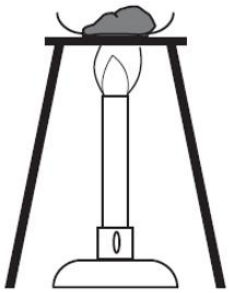
(iii) Why do they use the same volume of nutrient solution in both flasks A and B.

……

…… 1 mark

Maximum 4 marks

Q7. Peter was investigating the effect of heating some solid elements in air.
Two different elements were put in an open crucible and heated strongly in air.
The contents were weighed before and after heating.



(a) Which Bunsen Burner flame should Peter have used for this experiment?

…… 1 mark

Here are the results:

element	mass of crucible + contents before heating, in g	mass of crucible + contents after heating, in g
A	11.5	12.4
B	11.2	8.8

(b) (i) Suggest why the contents of crucible A increased in mass.

…… 1 mark

(ii) Suggest an element which A could be.

…… 1 mark

(c) (i) Suggest why contents of crucible B deceased in mass.

…… 1 mark

(ii) Suggest an element which B could be.

…… 1 mark

(d) Suggest how Peter could have checked that all the contents in crucible A had reacted.

……

……

…… 2 marks

Peter then repeated his experiment but used hydrated copper sulphate instead of the elements.
He noticed it turned from blue to white.

(e) Describe and explain what would have happened to the mass of the crucible and its contents during this experiment.

Description ……

……..

Explanation ……..

…… 2 marks

Maximum 9 marks

Q8. Yasmin was investigating the reaction between marble chips (calcium carbonate) and hydrochloric acid.
She used the same mass of marble each time, but changed the amount of acid she used and then measured the volume of gas given off as the reaction took place.

(a) (i) Name the gas given off.

…… 1 mark

(ii) Describe a positive test for this gas.

Test: ……

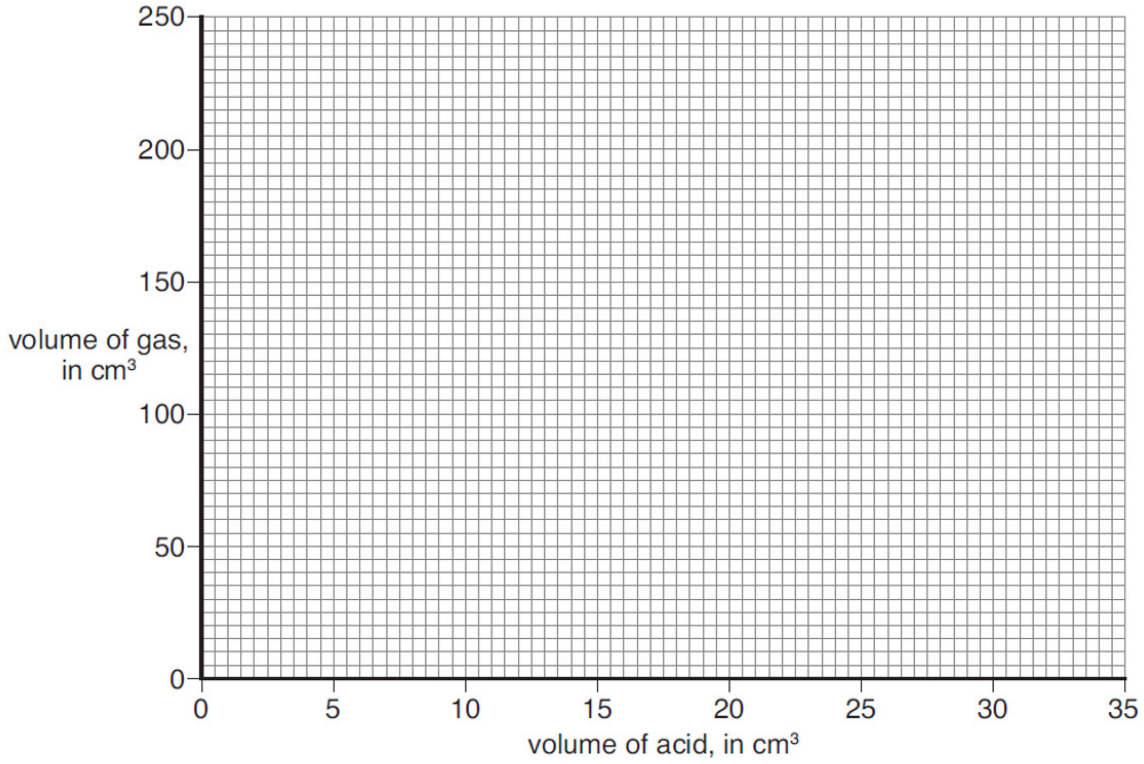
Results: …… 2 marks

Here are her results:

volume of acid, in cm^3	volume of gas, in cm^3
5	58
10	117
15	176
20	237
25	237
30	237

(b) **(i)** Plot the points on the graph below. 2 marks

(ii) Draw a suitable line through the points. 1 mark



(c) Describe and explain the shape of the graph

(i) up to 20cm^3 of acid

……..

…… 2 marks

(ii) above 20cm^3 of acid

……..

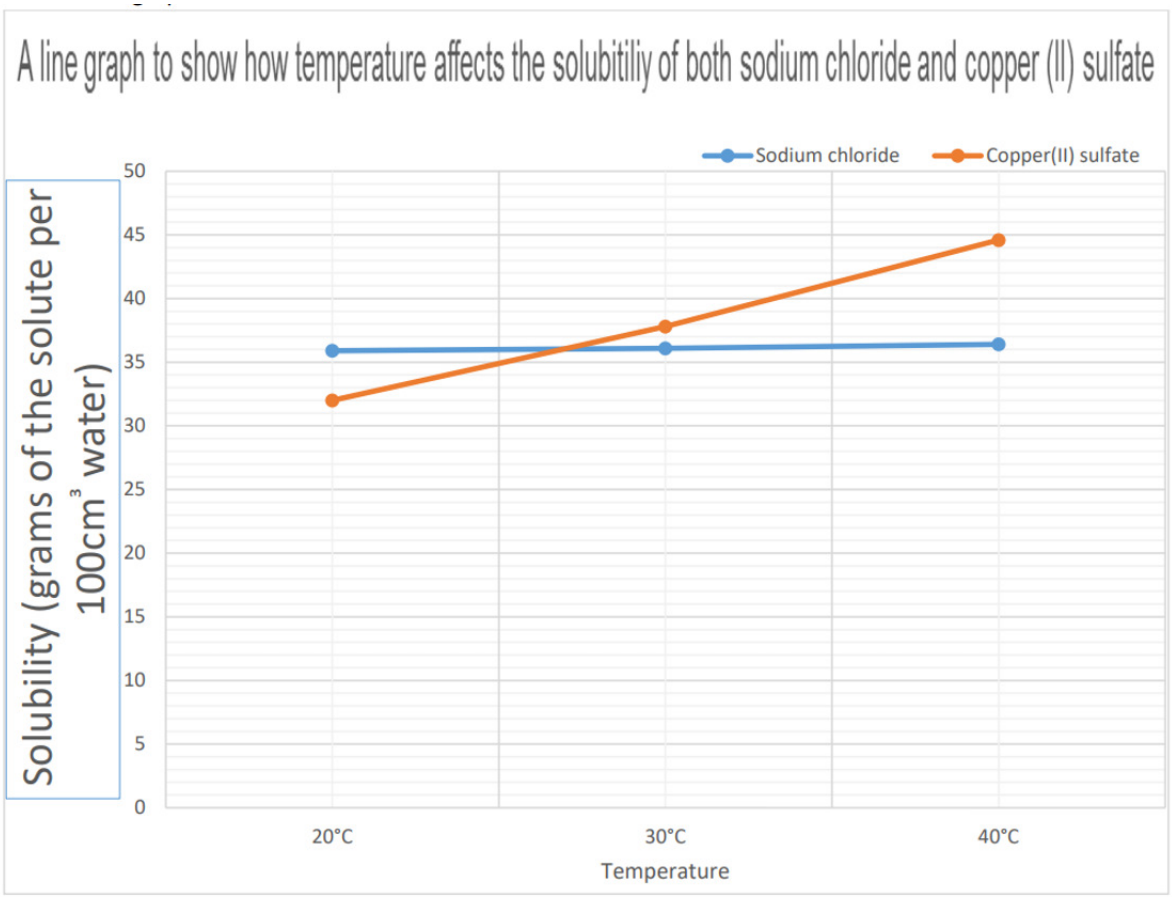
…… 2 marks

(d) Draw a labelled diagram of how Yasmin might have set up this investigation to collect and measure the gas given off.

4 marks

Maximum 14 marks

Q9. Look at the graph below.



(a) At what approximate temperature do both sodium chloride and copper II sulphate have the same solubility?

…… 1 mark

(b) Describe how the solubility of sodium chloride compares to the solubility of copper II sulphate at different temperatures.

……

……

……

…… 2 marks

(c) What do you predict would be the solubility of copper II sulphate at 50^0C?

…… 1 mark

(d) What is a solution called when it reaches a point where no more solute can be dissolved?

…… 1 mark

(e) The salt solutions are left in a beaker on a window sill and over the next few days the level starts to fall. What is the name of the process causing the level to fall?

…… 1 mark

(f) If 70 grams of copper II sulphate was added to 200cm3 of water, what is the approximate minimum temperature you would expect for the whole amount to dissolve? Show your working.

……

……

……

…… 2 marks

Maximum 8 marks

Q10. For the following questions tick **one** correct answer in the box provided:

i) In the Thermite reaction:

Iron III Oxide + Aluminium → Aluminium oxide + Iron

What reaction is occurring:

Just oxidation ☐

Just reduction ☐

Oxidation and reduction ☐

Decomposition ☐

ii) A glowing splint is put into a test tube containing a gas. The glowing splint does **NOT** relight. What is the gas definitely **not**?

Nitrogen ☐

Oxygen ☐

Carbon dioxide ☐

Hydrogen ☐

iii) Which gas contributes most significantly to acid rain from burning coal?

Sulphur dioxide ☐

Carbon monoxide ☐

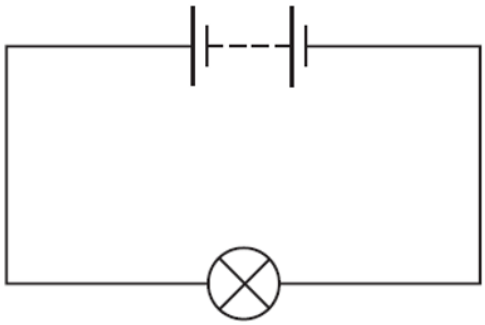
Carbon dioxide ☐

Nitrogen oxides ☐

Maximum 3 marks

QUESTIONS ON PHYSICS

Q11. The circuit diagram below includes a lamp and a battery.



(a) Peter wants to use an ammeter in the circuit.
What does an ammeter measure?

…… 1 mark

(b) Draw on the diagram to show where in the circuit Peter should connect an ammeter.
Use the circuit symbol. 1 mark

The table below shows the circuit which flows when three different lamps are connected one at a time in the circuit.

lamp	current, in amps
A	0.65
B	0.24
C	0.36

(c) Which lamp has the highest resistance? …… 1 mark

(d) Write a sentence which describes the relationship between resistance and the current that flows in these lamps.

……

……

…… 2 marks

(e) What should Peter expect the current flowing from the battery to be if two lamps like B are connected in parallel with it?

…… 1 mark

Maximum 6 marks

Q12. James hammers some fence posts into the ground in his garden.
One post has a tip which has an area of 2cm2.
When the hammer hits the post, it causes a force of 500N to act on it.

(a) (i) Give the equation which relates pressure, force and area.

…… 1 mark

(ii) Calculate the pressure exerted at the tip. (Give the unit.)

……

……

…… 2 marks

(b) Some of his posts have sharper joints than others.
Explain why James will find it easier to hit the sharper posts into the ground.

……

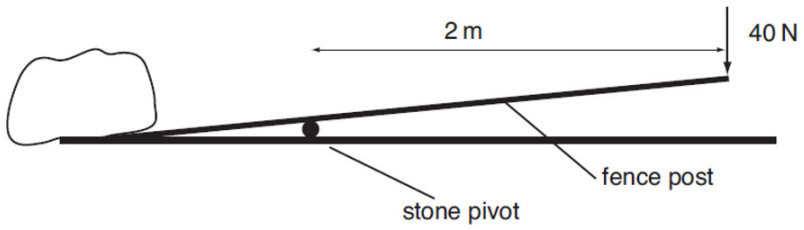
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…… 2 marks

James uncovers a large rock in the garden.

He cannot easily move it, so he uses a fence post as a lever to help him.

He uses a round stone as a pivot.



The horizontal distance from James to the stone pivot is 2m.

He pushes down with force of 40N and the rock just starts to lift.

(c) Find the moment which James is producing. (Give the unit)

……

……

…… 3 marks

(d) The horizontal distance from the rock to the stone pivot is 0.5m.
Ignoring the weight of the post, calculate the weight of the rock.

……

……

…… 2 marks

(e) In reality, the post does have a weight.
State whether this means that the weight of the rock is less than, or the same as your answer to (d)

…… 1 mark

(f) State two things which James could do to increase the moment which he is producing.

1: ……

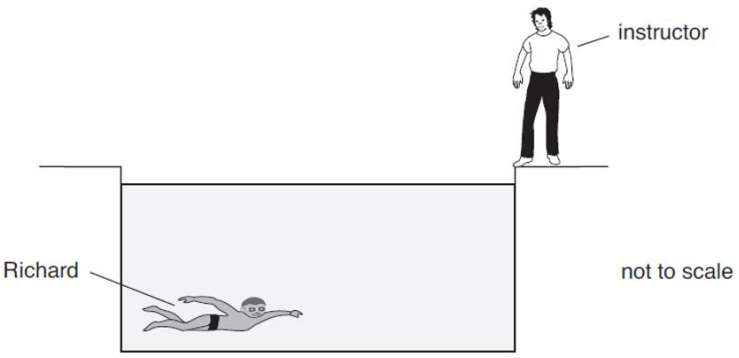
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2: ……

…… 2 marks

Maximum 13 marks

Q13. An instructor, standing at the side of the pool, is watching Richard swimming underwater.



(a) When the instructor sees Richard, he appears to be in a different position from his real one.
Explain why this happens.

……

……. 1 mark

(b) In order for the instructor to see Richard, a ray of light must travel from Richard to his eye.
Draw on the diagram the approximate path taken by a ray which does this.
2 marks

(c) The pool measures 15 meters long and 10 meters wide. The water depth is 3 meters.
Calculate the volume of water in the pool. (Give the unit)

……

……. 2 marks

(d) **(i)** Give the equation which relates density, mass and volume.

……. 1 mark

(ii) The density of water is 1000kg/m^3.

Show that the mass of the water is 450 000kg.

……

……. 2 marks

Maximum 8 marks

Q14. Underline the option which best completes each of the following:

(a) The unit of energy is the

amp **joule** **newton** **volt**

(b) If a football is held between a small bright light source and a screen, the shadow cast will be sharp at the edge; this shows that

light disperses to give a spectrum

light is reflected from shiny surfaces

light travels at about 300 000 000 metres per second

light travels in straight lines

(c) To calculate the speed of a moving object the two measurements needed are

area and force **distance and time**

force and time **mass and volume**

Maximum 3 marks

TOTAL MARK FOR PAPER 100