

Name:



OUNDLLE

School

2015 Non Common Entrance Examination
Third and Fourth Form Entry

Science

Time Allowed : 1 hour

- *Please write your name in the box above*
- *Answer as many questions as you can in the time available*
- *Calculators may be used*
- *The paper is out of 60 marks; 20 for Biology, 20 for Chemistry, and 20 for Physics*

You will need:

- *A pen*
- *A pencil*
- *A ruler*
- *A calculator*

Biology mark /20	
Chemistry mark /20	
Physics mark /19	
Total mark /59	
Percentage	

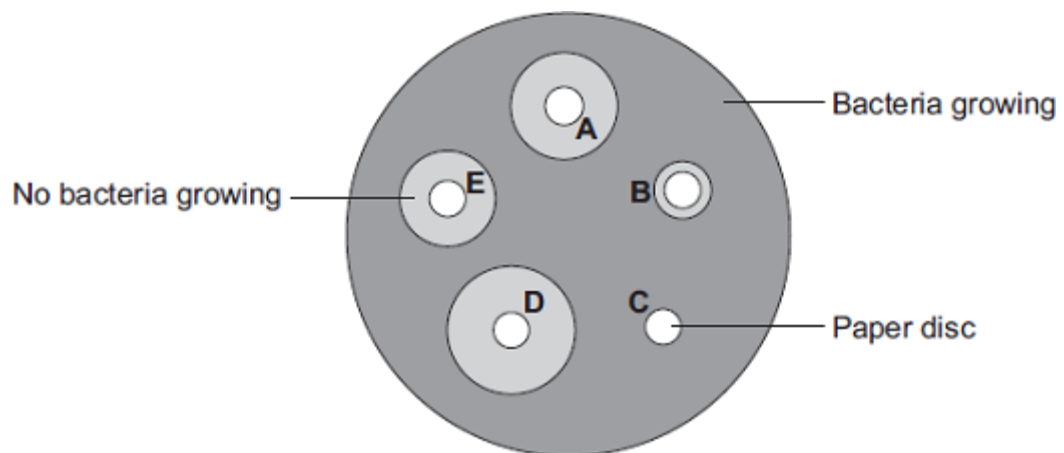
Biology Section

1. Students in a school investigated the effect of five different antibiotics, **A**, **B**, **C**, **D** and **E**, on one type of bacterium.

The students:

- grew the bacteria on agar jelly in a Petri dish
- soaked separate paper discs in each of the antibiotics
- put the paper discs onto the bacteria in the Petri dish
- put the Petri dish into an incubator.

The diagram shows what the Petri dish looked like after 3 days.



- a. What is the maximum temperature the incubator should be set at in the school?

Circle the correct answer.

10°C 25°C 50°C

(1)

- b. Complete the following sentence using one of the words in *italics* below.

pathogens *toxins* *viruses*

“The incubator should **not** be set at a higher temperature because the higher temperature might help the growth of

(1)

- c. Using the diagram on the previous page, which antibiotic, A, B, C, D or E, would be best to treat a disease caused by this type of bacterium?

Give reasons for your answer

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(2)

- d. Antibiotics cannot be used to treat diseases caused by viruses. Why is this the case?

Tick (✓) one box.

Viruses are not pathogens

There are too many different types of virus

Viruses live inside cells

(1)

[Total 5 marks]

2. The table below is from a packet of biscuits.

Average values	Per 100 g	Per biscuit	UK guideline daily amounts	
			Adults	Children (5 – 10 years)
Energy	1974 kJ	446 kJ	8500 kJ	7500 kJ
Protein	7.1 g	1.1 g	45 g	24 g
Carbohydrate	62.8 g	9.3 g	230 g	220 g
Fat	21.3 g	3.2 g	70 g	70 g
Sodium	3.6 g	0.5 g	2.4 g	1.4 g

One day a ten-year-old child ate a whole packet of the biscuits.

The biscuits in the pack had a mass of 400 g.

a. How many grams of carbohydrate did the child eat?

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(2)

b. The amount of carbohydrate you calculated in part (a) was more than the UK guideline daily amount for the child.

How much more?

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(1)

c. Give two possible health effects on the child of eating so many biscuits every day.

1.

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2.

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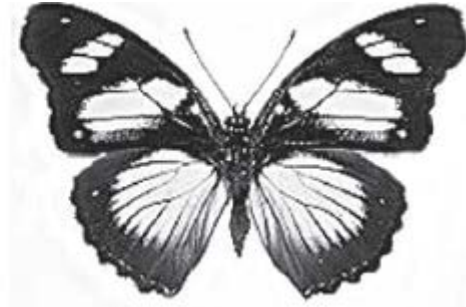
(2)

[Total 5 marks]

3. The drawings show two different species of butterfly.



Amauris



Hypolimnas

- Both species can be eaten by most birds.
- *Amauris* has an unpleasant taste which birds do not like, so birds have learned not to prey on it.
- *Hypolimnas* does not have an unpleasant taste but most birds do not prey on it.

a. Suggest why most birds do not prey on *Hypolimnas*.

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(2)

- b. Suggest an explanation, in terms of natural selection, for the markings on the wings of *Hypolimnas*.

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(3)

[Total 5 marks]

4. The photograph shows an athlete at the start of a race.



a. The athlete's sense organs contain special cells.
These special cells detect changes in the environment.

List A shows changes in the environment.

List B shows some of the athlete's sense organs.

Draw one line from each change in the environment in List A to the sense organ detecting the change in List B.

List A Change in the environment	List B Sense organ
Sight of the finishing line	Ear
Sound of the starting gun	Nose
Pressure of the ground on the fingers	Eye
	Skin

b. Which cells detect changes in the environment?

Tick (✓) one box.

Gland cells

Muscle cells

Receptor cells

(1)

c. During the race, the concentration of sugar in the athlete's blood decreases.

Why?

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(1)

[Total 5 marks]

[Total Biology 20 marks]

Chemistry Section

5. Sam carries out some experiments to make salts.

He uses the following chemicals – hydrochloric acid, sulphuric acid, nitric acid, calcium carbonate, magnesium carbonate and magnesium oxide.

- a. Name one safety precaution that Sam could take when carrying out his experiments.

..... (1)

- b. Sam makes some magnesium sulphate.

- i. Which acid should Sam use to make magnesium sulphate?

..... (1)

- ii. Sam knows that two of the chemicals react with sulphuric acid to make magnesium sulphate.

Give the names of **two** chemicals that Sam could add to the acid to make magnesium sulphate.

..... (1)

- iii. Sam adds some magnesium oxide to hydrochloric acid.

Write a word equation to show what happens when magnesium oxide reacts with hydrochloric acid.

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..... (2)

- c. All of the reactions that Sam carries out involve neutralising an acid.

What simple test can be used to prove that an acid has been neutralised?

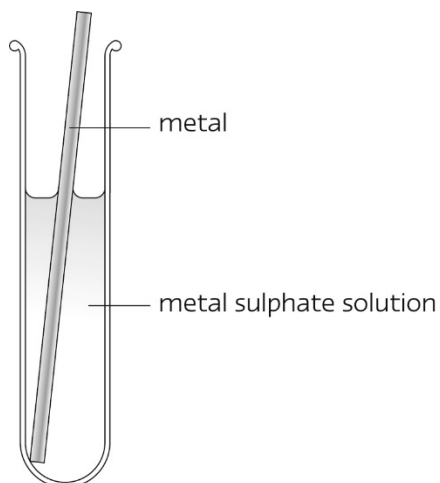
Test:

Result:

(2)

[Total 7 marks]

6. Milly carried out some metal displacement reactions.
She added different metals to solutions of metal sulphates to see whether a reaction happened.



The table shows some of her results.

Key: ✓ = reaction happens ✗ = no reaction

Metal	Metal sulphate solution			
	Copper sulphate	Zinc sulphate	Iron sulphate	Magnesium sulphate
Copper		✗	✗	✗
Zinc	✓		✓	✗
Iron	✓	✗		✗
Magnesium				

- a. Complete the table by filling in the boxes to show whether a reaction happens when magnesium is added to each metal sulphate.

(3)

b. Put the metals in order 'most reactive' to 'least reactive'.

Most reactive

magnesium

Least reactive

(1)

c. Give the name of another metal that would give the same results as copper in the table.

.....

(1)

d. The table shows the appearance of some of the substances in the table.

Substance	Appearance
Copper	Orange metal
Zinc	Grey metal
Copper sulphate solution	Blue solution
Zinc sulphate solution	Colourless solution

i. How will the appearance of the **zinc** change when it is added to copper sulphate solution?

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(1)

ii. How will the appearance of the **copper sulphate solution** change when the zinc is added?

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(1)

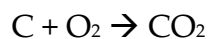
[Total 7 marks]

7. When petrol burns in a car engine, the carbon atoms in the petrol react with oxygen.

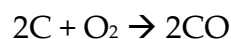
Carbon dioxide and carbon monoxide form and come out of the exhaust of the car.

The equations show how these gases form.

Equation 1: carbon + oxygen \rightarrow carbon dioxide



Equation 2: carbon + oxygen \rightarrow carbon monoxide



Both reactions involve carbon reacting with oxygen

- a. Give one other way that the two reactions are similar.

..... (1)

- b. Give one way that the two reactions are different.

..... (1)

Carbon monoxide is very toxic.

One way of making carbon monoxide safer is to react it with oxygen to make carbon dioxide.

- c. Write a symbol equation to show carbon monoxide reacting with oxygen to make carbon dioxide.

..... (2)

- d. The melting point of carbon monoxide is -205°C and the boiling point of carbon monoxide is -191.5°C .

What state would it be in at the following temperatures:

At -245°C carbon monoxide would be

At -200°C carbon monoxide would be

(2)

[Total 6 marks]

[Total Chemistry 20 marks]

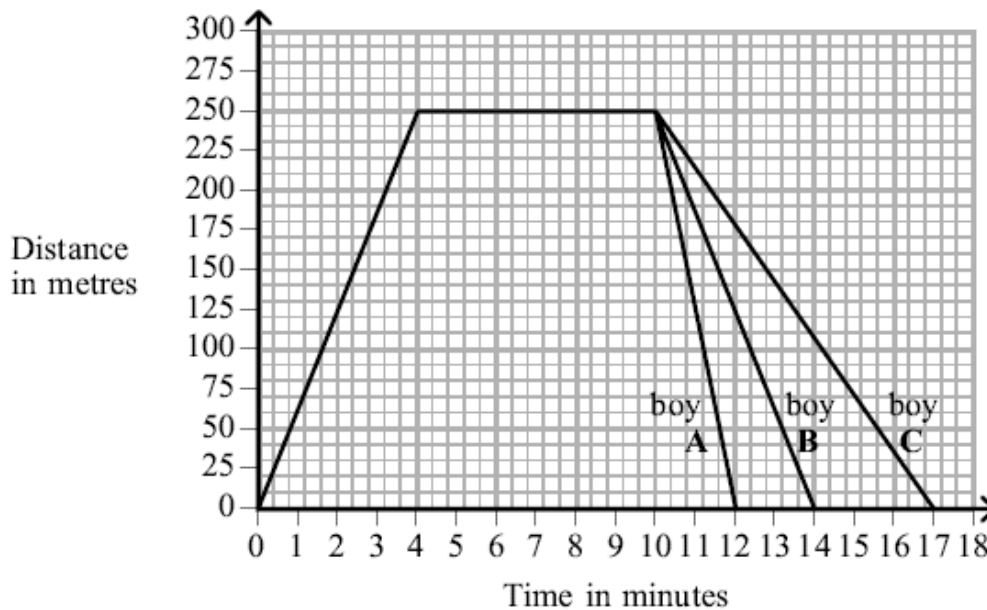
Physics Section

8. Three brothers, A, B, and C all walk together from their home to a shop.

When they leave the shop

- One boy runs home,
- One boy walks home,
- One boy walks home slowly.

The graph below shows how their distance from home varies with time.



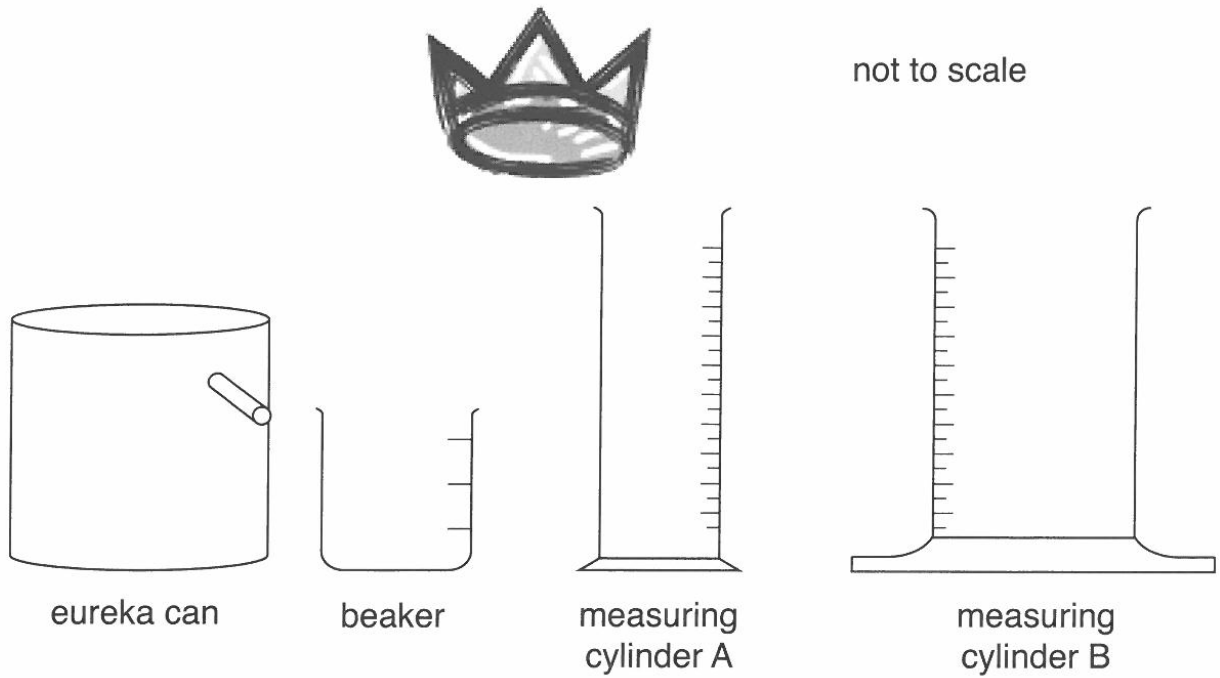
Complete the spaces in the following sentences.

- The shop is a distance of metres from the boys' home.
- The boys are in the shop for a time of minutes.
- Boy walks home slowly, boy walks home and boy runs home.
- Boy C takes minutes more than boy A to get home.
- The slowest boy is away from home for minutes.

(5)

[Total 5 marks]

9. A king wanted to check that his crown was made of pure gold.



The pieces of apparatus shown in the diagram above were available to him.

a. Suggest how the king could measure the volume of the crown.

It will fit in the eureka can, but not in any of the other containers.

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- b. State which measuring cylinder would give the more precise reading. Explain why.

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(2)

- c. Name a piece of apparatus the king could use to measure the mass of the crown.

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(1)

The density of gold is 19.3g/cm^3 .

- d. The king found the volume of the crown was 31cm^3 , and its mass was 598g .

- i. Write down the formula which relates density to mass and volume.

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(1)

- ii. By calculating the density of the crown, decide whether it is made of gold.

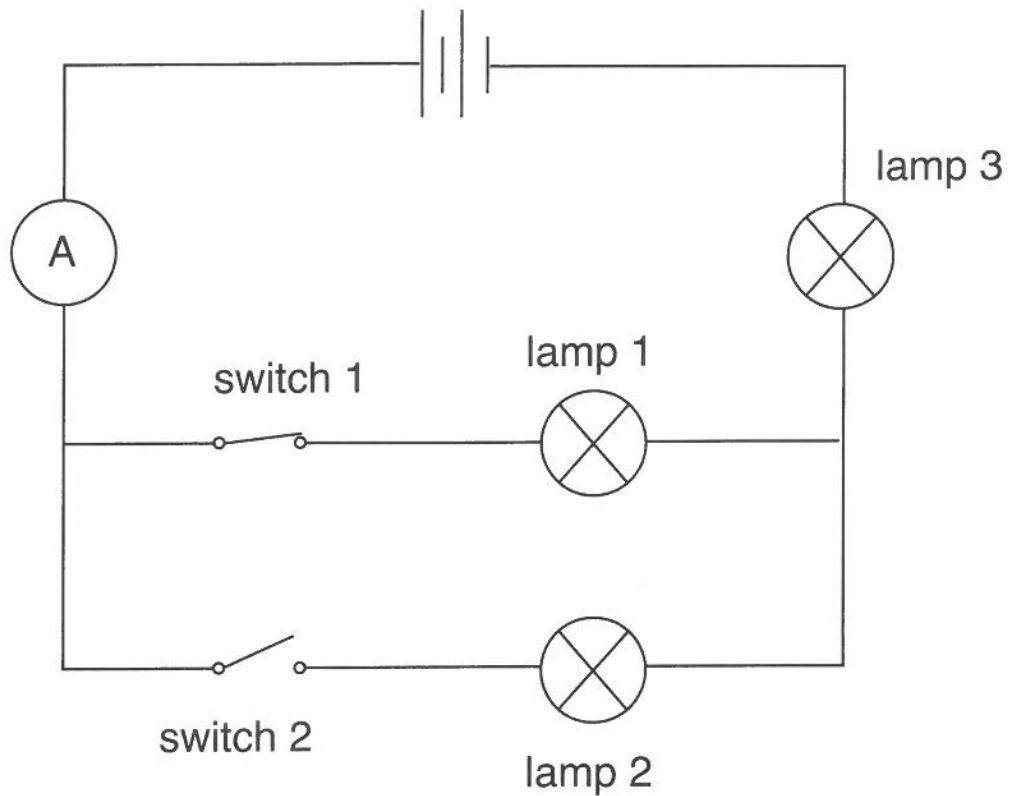
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(2)

[Total 8 marks]

10. Jason connects the circuit below.



All the lamps in the circuit above are similar.

- a. When only switch 1 is closed, the ammeter reads 0.2.
What is the unit of this reading?

..... (1)

- b. Jason now closes switch 2 as well.
i. State what happens to the ammeter reading.

..... (1)

- ii. State whether lamp 3 will be brighter, dimmer or the same brightness as before.

..... (1)

- iii. State whether lamp 1 will be bright, dimmer or the same brightness as before.

..... (1)

c. On the circuit diagram above

- i. Draw another ammeter to measure the current through lamp 2.

(1)

- ii. Add another switch which would enable all 3 lamps to be turned on or off at the same time.

(1)

[Total 6 marks]

[Total Physics 19 marks]