Name and School:

OUNDLE
School

2016 Academic Scholarship

Preliminary Examination

Science

Time Allowed : One hour

- Write your name on the question paper
- Write all your answers on the question paper
- Calculators are allowed

Biology Section

1. The table shows the percentage of protein, fat, and minerals found in the same mass of meat from different animals.

Meat	**Protein (%)**	**Fat (%)**	**Minerals (%)**
Beef	19.0	17.0	0.9
Chicken	21.0	2.5	1.1
Lamb	17.5	20.0	1.0
Pork	16.0	25.0	0.9
Rabbit	21.0	3.5	1.5

a.

i. Which meat contains the least protein?

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(1)

ii. Calculate how many grams of protein are present in one kilogram of rabbit meat. Show your working.

Answer ..... g

(2)

b. Which type of meat would provide the most energy?

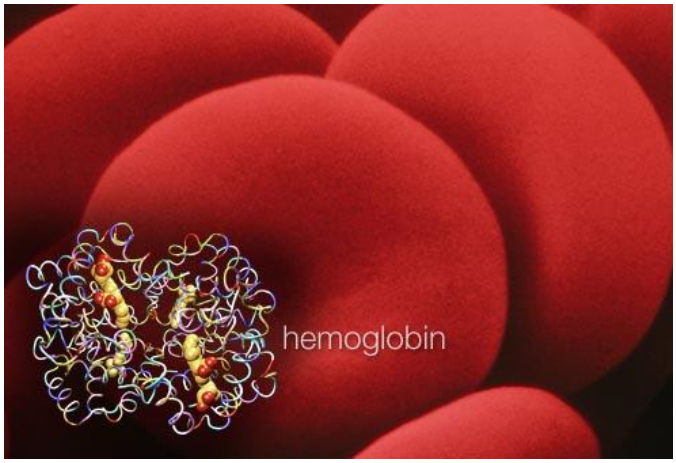
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(1)

[Total 4 marks]

2. The pictures below show red blood cells. Red blood cells contain a protein called haemoglobin which helps them transport.

   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 8.5cm. What is their diameter in μm? Make sure you show your working.

Answer ..... μm

(2)

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

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(2)

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

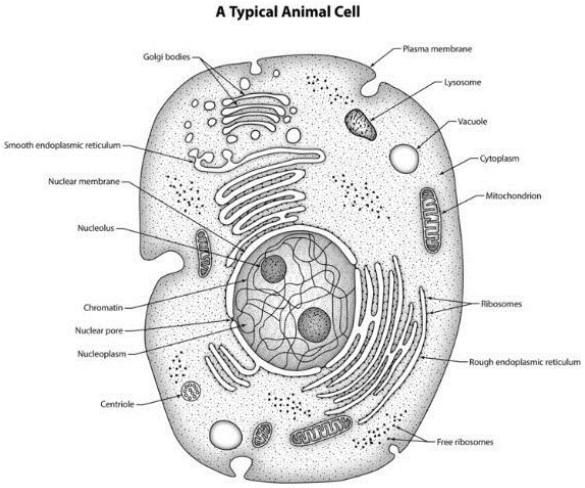
Answer .....

(2)

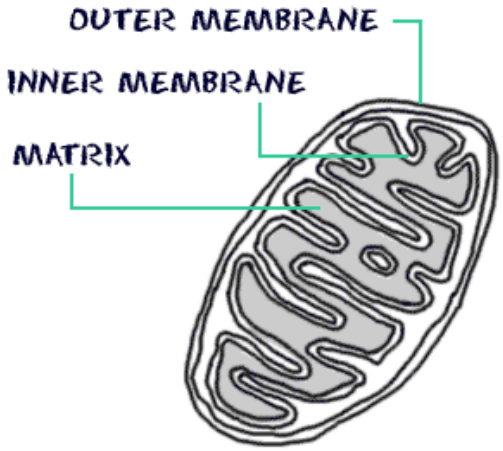
[Total 6 marks]

3. The diagrams below show the detailed structure of a typical animal cell (on the left) and the detail of a specific part of the cell called a mitochondrion (on the right).

   Aerobic respiration occurs in the mitochondria.



Animal Cell



Mitochondrion

   a. Name two substances required in aerobic respiration.

   .....

   .....

   (1)

   b. Name two substances, other than energy) that are produced by aerobic respiration

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   (1)

c. Onions and potatoes are underground storage organs for plants. Name one structure that is found in these organs that is not found in their leaves and explain why.

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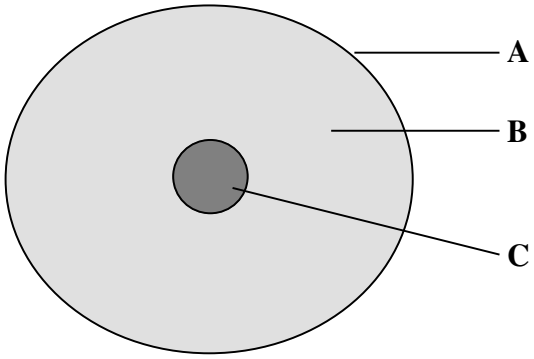
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(2)

[Total 4 marks]

4. 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)

b. Which part of the cell contains the chromosomes?

.....

(1)

c. The cell in the 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)

[Total 6 marks]

Total marks for Biology Section = 20 marks

Chemistry Section

2. The purity of a sample of copper can be checked using concentrated nitric acid.
   The copper in the piece of metal is dissolved in the acid and the remaining unreacted impurities can be weighed.
   During the reaction the following change takes place:

   Copper + Nitric Acid → Copper (II) Nitrate + Nitrogen Dioxide + Water

   Copper (II) nitrate is soluble and nitrogen dioxide is a gas.

   a. Draw a fully labelled diagram of the apparatus you could use to collect the insoluble impurities formed in this reaction.
      It can be drawn freehand.

(4)

   b. The (II) in Copper (II) nitrate, relates to the positive charge on the copper ion. The nitrate ion has a charge of -1. Write a balanced chemical equation for the reaction of copper and nitric acid.

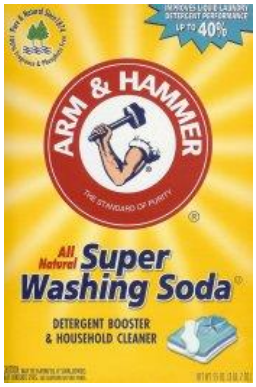
(3)

c. In an experiment a 2.36g sample of copper is reacted and found to contain 0.63g of impurities. Calculate the percentage purity of the sample of copper.

(2)

[Total 9 marks]

3. Washing soda contains the compound sodium carbonate.





a. Which gas is given off when sodium carbonate reacts with dilute hydrochloric acid?

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(1)

b. Describe a positive test for the gas in part (a) of the question.

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(2)

c. Write down the general word equation for a carbonate reacting with an acid.

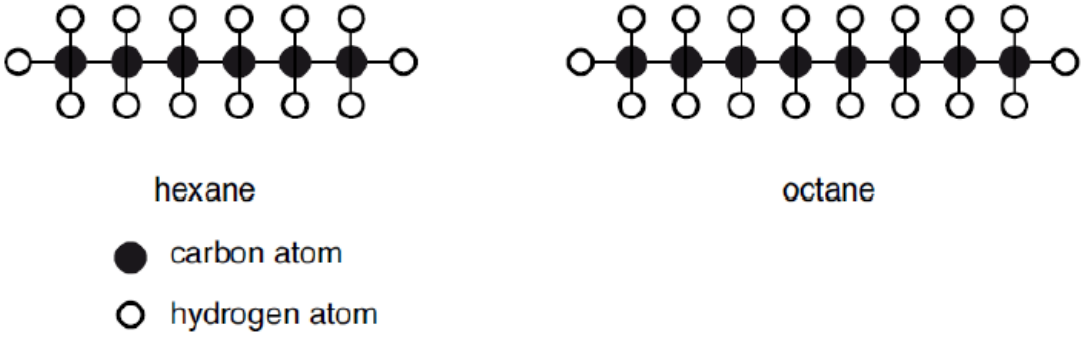
(2)

[Total 5 marks]

4. Petrol is a fossil fuel vital to modern life.



a. Petrol is a mixture of a number of different chemicals. The molecules of two such chemicals, hexane and octane, are drawn below.



Hexane and Octane are classified as hydrocarbons because they contain only atoms of hydrogen and carbon.

i. Other than the similarity stated in the question, explain one further similarity between a hexane molecule and an octane molecule.

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.....

(1)

ii. Explain one difference between a hexane molecule and an octane molecule.

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(1)

b. The boiling points of hexane and octane are 69 °C and 125 °C. Suggest how a mixture of octane and hexane could be separated.

.....

.....

(1)

c. The exhaust gases from the combustion of a petrol in a car engine can have various harmful environmental effects. One of these gases is carbon dioxide. Name and give the formula of one of the other harmful gases from the exhaust fumes of combustion and describe the effects it has on the environment.

Name:

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Effects:

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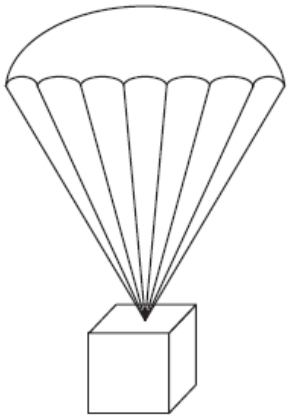
(3)

[Total 6 marks]

Total marks for Chemistry Section = 20 marks

Physics Section

1. The diagram shows a box attached to a parachute, falling at a constant velocity.



a. State the name for this constant velocity.

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(1)

b. Explain, in terms of forces, why the box and parachute fall at constant velocity.

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(4)

[Total 5 marks]

2. Planets and comets in our solar system orbit the Sun.

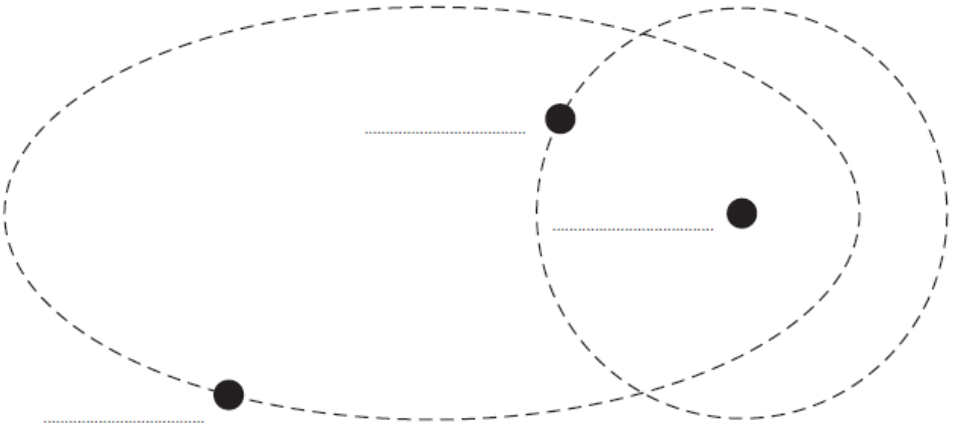
a. Which force causes planets and comets to orbit the Sun?

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(1)

b. The diagram shows the orbits of a planet and a comet around the Sun.

[not to scale]

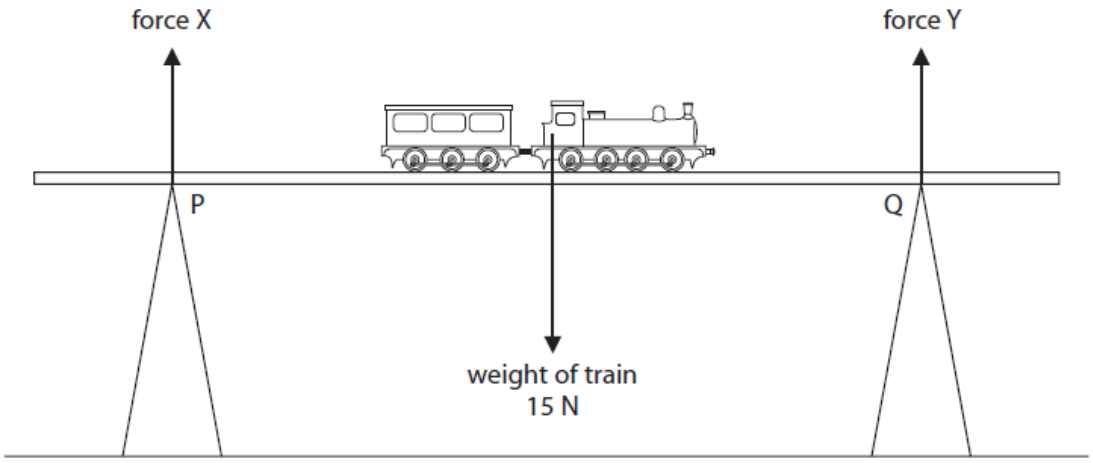


i. On the diagram, label the planet, the comet, and the Sun.

(1)

[Total 2 marks]

3. A toy train is placed on the middle of a bridge on a model railway.



The weight of the train acts through its centre of gravity.
Ignore the weight of the bridge.

a. Which row of the table shows the correct values for forces X and Y? Put a cross in the correct box.

	force X	force Y
☒ **A**	7.5 N	7.5 N
☒ **B**	0 N	0 N
☒ **C**	0 N	15 N
☒ **D**	15 N	0 N

(1)

b. Describe how force X changes if the train moves from P to Q.

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(3)

[Total 3 marks]

4. The photograph shows a water barrel with a tap.

The barrel is used to store rainwater.



A student investigates the water depth in the barrel.

She measures the depth and then opens the tap.

As water flows out of the barrel, she measures the depth every minute.

The table shows her results

Time in minutes	Depth in cm
0	86
1	52
2	31
3	18
4	11
5	7
6	4

a. Which two measuring instruments should the student use in her investigation.

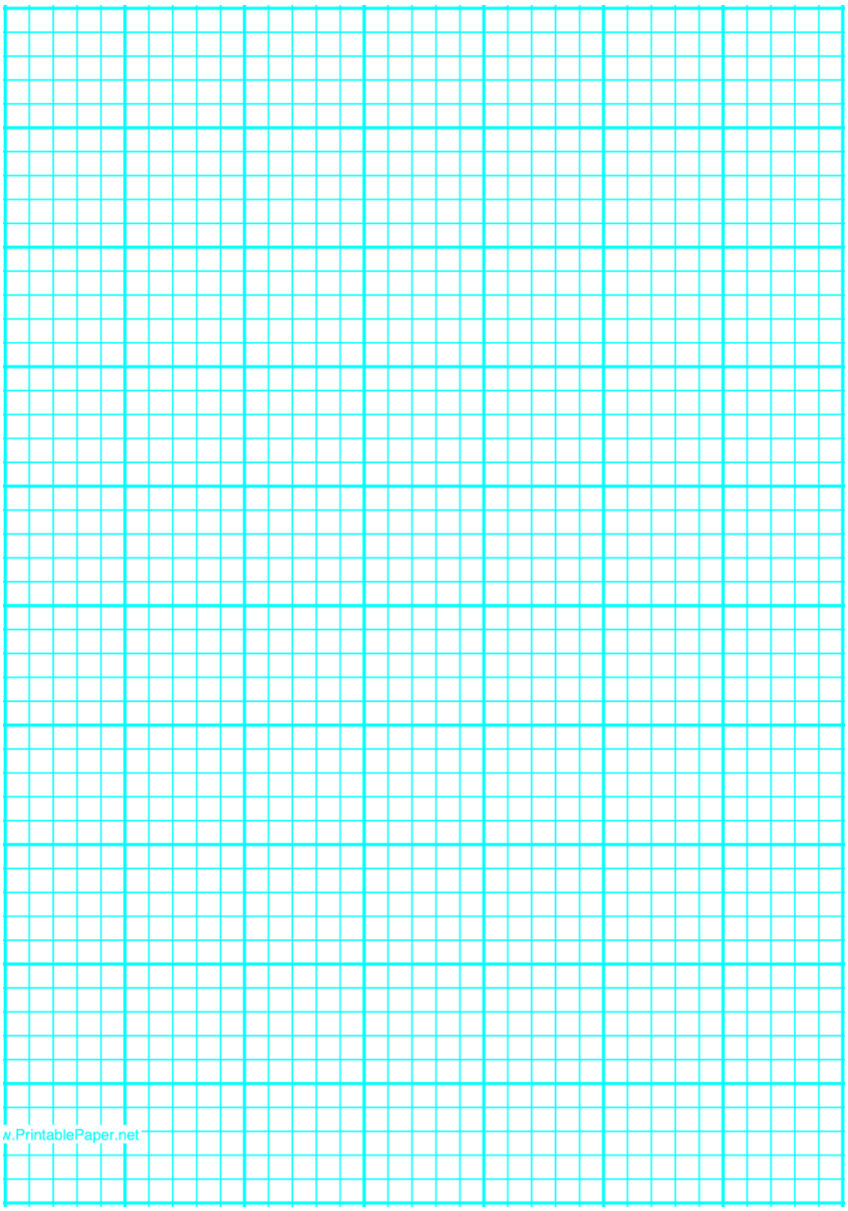
1. .....

2. .....

(2)

b.

i. Plot a graph to show how the depth changes with the time, and draw the curve of best fit.



(5)

ii. Describe the relationship between depth and time.

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(2)

c. The student notices that the water flows out less quickly as time passes.

Suggest a reason for the decrease in flow.

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(1)

[Total 10 marks]

Total marks for Physics Section = 20 marks