SEVENOAKS SCHOOL

YEAR 9 (13+) SCHOLARSHIP

May 2019
for entry in September 2019

SCIENCE 1

Your Name: _____

Your School: _____

Time allowed: 1 hour

Equipment needed: Pen, pencil, and ruler.
You may use an eraser and a calculator if needed.

Information for candidates:

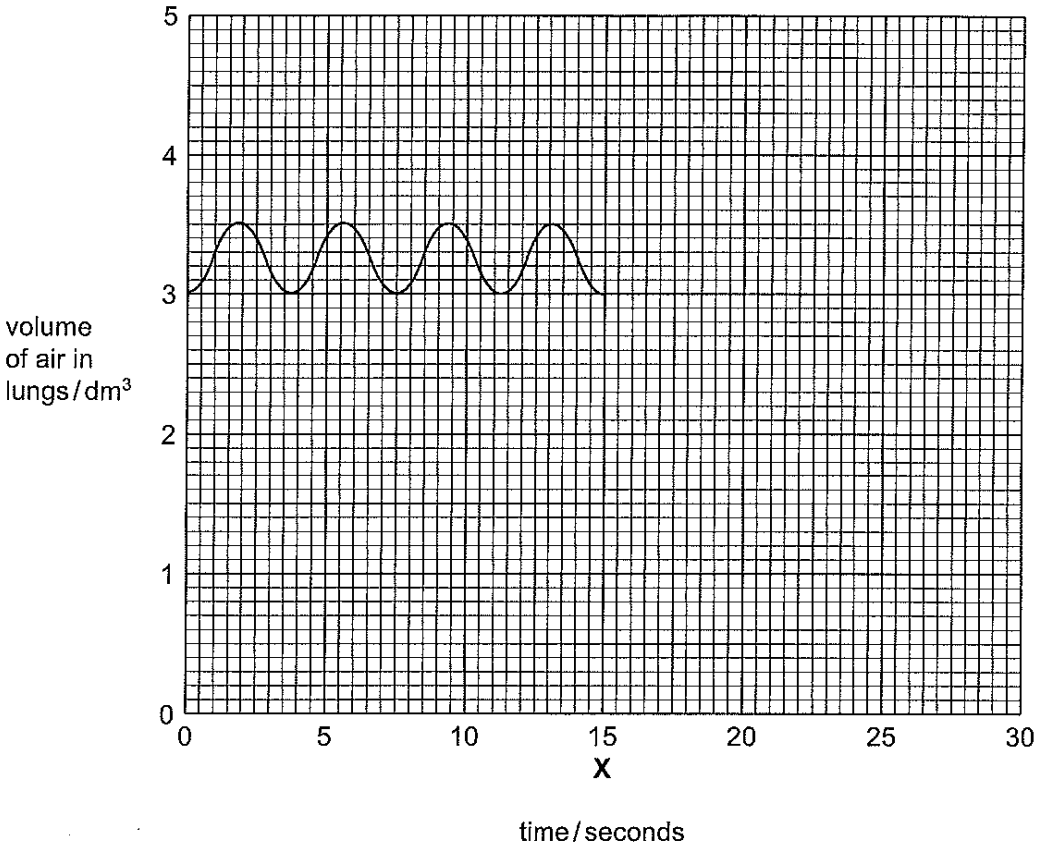
1. Write your name and school on this page.
2. Write all of your answers on the question papers in the space provided. If you need additional paper then please ask the invigilator. Please put your name on the sheets of paper you use.
3. The marks for each question or part question are shown in square brackets [ ] after the question.
4. Answer **ALL QUESTIONS** in **SECTION A** and **ONE QUESTION ONLY** from **SECTION B**.
5. The total mark for this paper is 70.

Section A

Answer ALL questions in this section.

BIOLOGY

1. The graph below shows the volume of air flowing into and out of the lungs of a human while breathing at rest.



a) State how many breaths are inhaled in 15 seconds. [1]

_____

b) State the volume of air breathed in during each breath. [1]

_____

c) Calculate the volume of air breathed in during one minute. Show your working. [2]

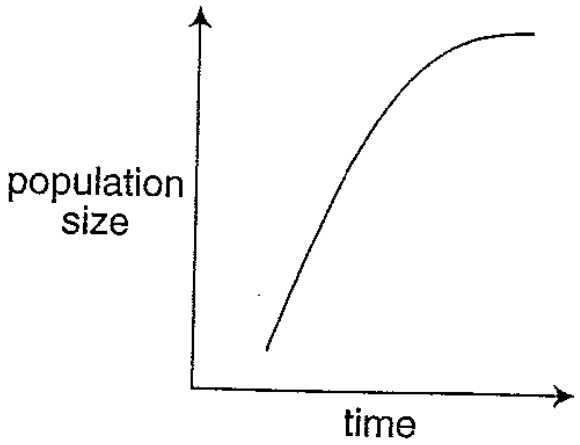
_____

_____

_____

d) At time **X** the person began to exercise. Sketch on the graph five more breaths for this person during this exercise. [2]

2. The graph shows how the size of the population of a certain species of animal changes with time.



a) Describe what the graph tells you. [2]

_____

_____

_____

b) Suggest a reason for the shape of the graph. [2]

_____

_____

_____

c) Suggest **two** factors which may cause the population size of an animal species to fall suddenly in its natural habitat. [2]

1. _____

_____

2. _____

_____

d) Animals normally decompose after they die. Name **two** kinds of organism responsible for decomposition. [2]

_____

and _____

e) Give **two** reasons why decomposition is important in nature. [2]

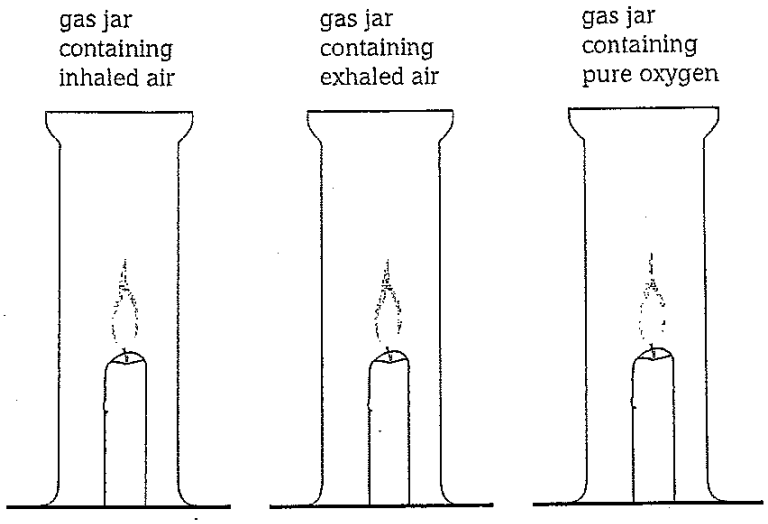
1. _____

_____

2. _____

_____

3. Mrs Brown the science teacher set up three gas jars and timed how long it took for each candle to go out. The diagrams show exactly what she did.



a) Predict the order that the candles would go out and justify your answer. [2]

_____

_____

b) Give one experimental detail that Mrs Brown would have to do to make it a fair test. [2]

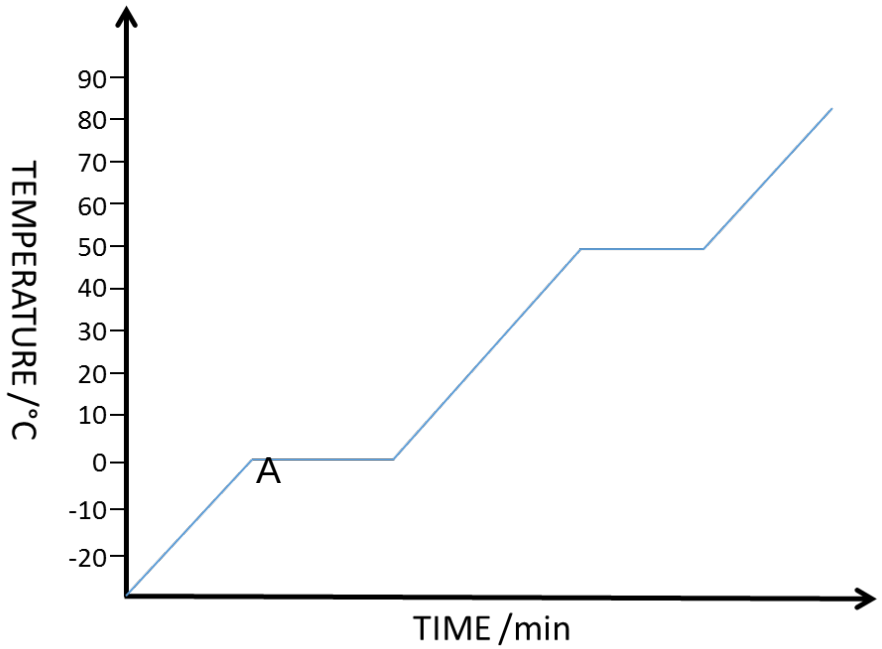
_____

_____

4. State the names of the following compounds from the given formulas. [2]

FORMULA	NAME
H_2SO_4	
$MgCl_2$	

5. The diagram below shows what happens to the temperature of a pure substance, X, when it is heated slowly.



a) Using the diagram, determine the approximate boiling point of substance X. [1]

Boiling point = _____ °C

b) State and explain the change in the movement of the particles in substance X in the sloped sections of the diagram. [2]

_____

_____

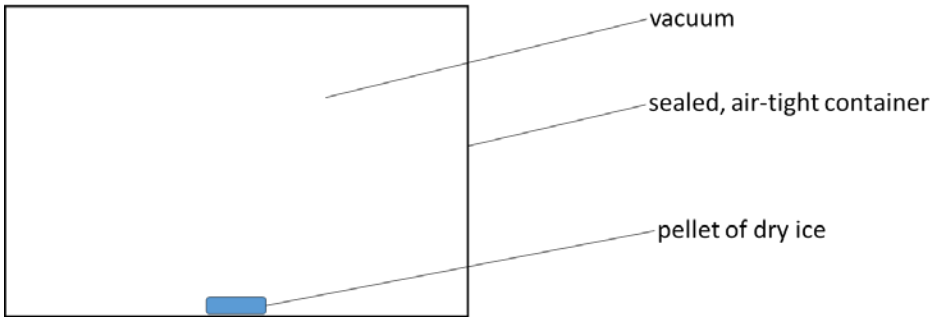
c) Explain why the temperature of substance X does not increase at point **A** despite the fact it is still being heated. [2]

_____

_____

d) On the diagram above, add a line to show the temperature of a new substance, Y, that is heated gently from -10 °C to 80 °C and undergoes sublimation at 70 °C. [2]

6. A pellet of dry ice (solid carbon dioxide) is placed is a container that is then sealed tight and has all the air removed from it to create a vacuum.



The container is placed on an electronic balance and its mass is recorded as 107 g. The container is then heated until the dry ice turns into a gas. The container is placed on the balance again and its mass recorded for a second time.

a) Suggest a value for the mass of the container when it is recorded for the second time. [1]

Mass of container = _____ g

b) State what happens to the pressure inside the container after it has been heated. [1]

_____

c) Anthropogenic (man-made) carbon dioxide produced by the burning of fossil fuels is implicated in potentially damaging and long-lasting effects on the environment.

(i) State the names of two types of fossil fuel. [1]

_____

(ii) State **one** way in which carbon dioxide may cause damage to the environment. [1]

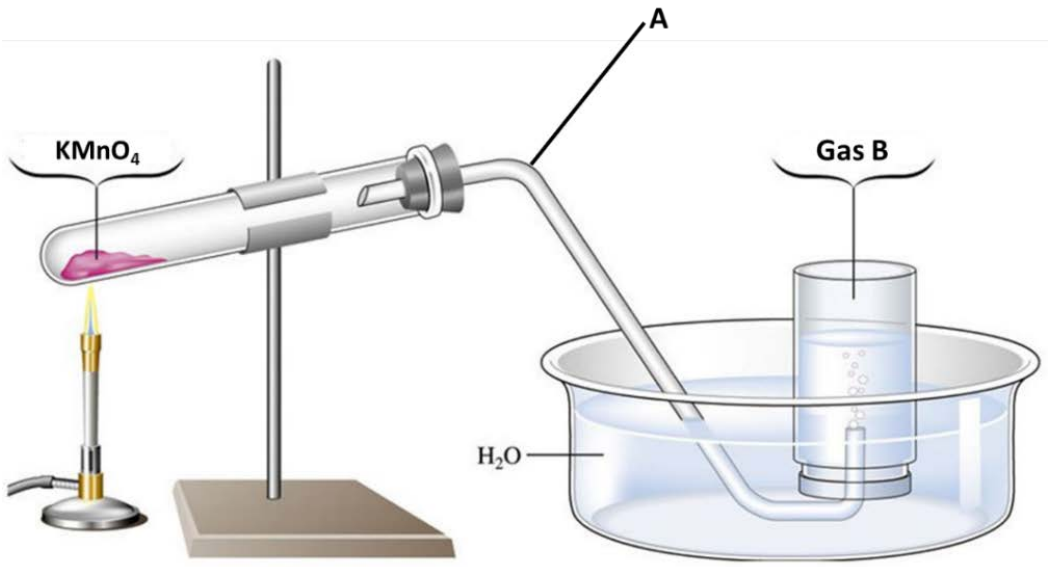
_____

(iii) Suggest **one** way, *other than reducing the amount of fossil fuels burned*, in which the level of carbon dioxide in the atmosphere could be reduced. [1]

_____

_____

7. Some potassium permanganate is heated in a boiling tube using a Bunsen burner. A reaction occurs and gas B is evolved.



a) Identify the piece of apparatus labelled **A**. [1]

_____

b) State the name of the type of reaction that occurs. [1]

_____

c) Identify gas **B** and describe a method for testing its identity. [3]

Name of gas **B** = _____

Test _____

_____

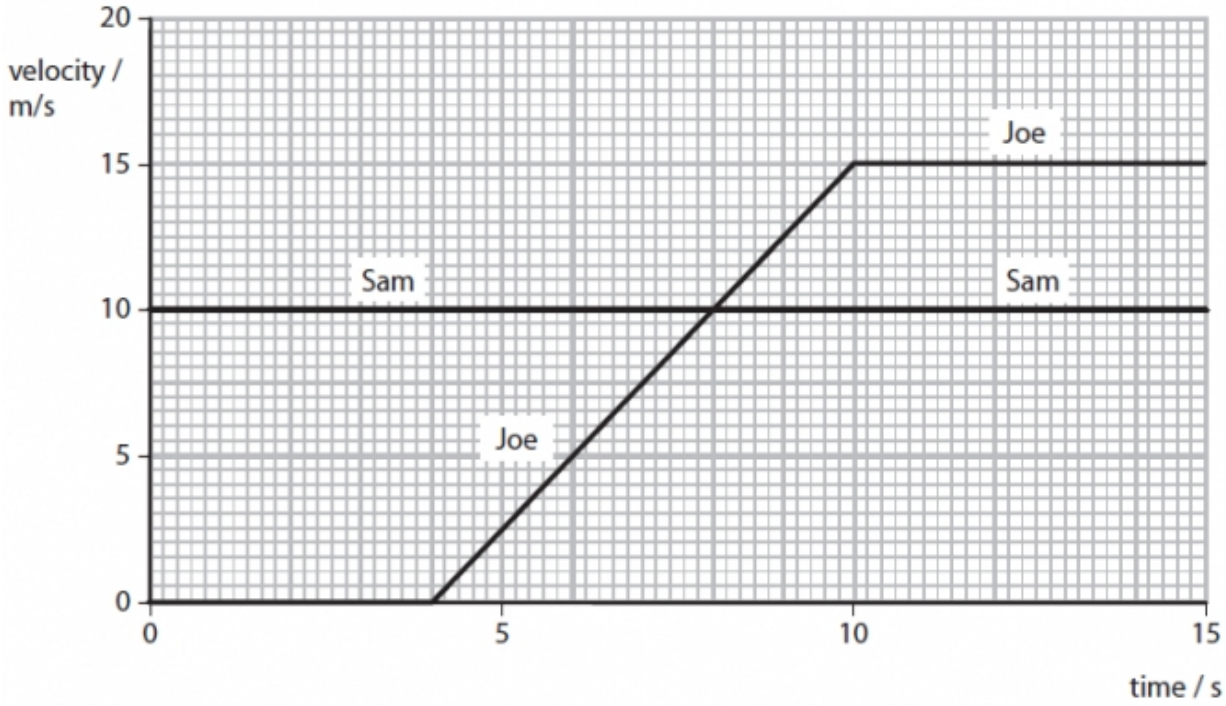
d) Explain why is it important to remove the piece of apparatus **A** from the gas collection jar before turning off the Bunsen burner. [1]

_____

8. a) Sam and Joe are on their bikes. They are on a flat, straight road. Joe is stationary when Sam rides past at a constant velocity of 10 m/s.

Joe waits for 4 s and then follows Sam.

This is a velocity/time graph of their motion.



(i) How far did Sam travel during these 15 s? [1]

Distance = velocity × time

Put a cross (☒) in the box next to your answer.

☐ **A** 1.5 m

☐ **B** 10 m

☐ **C** 100 m

☐ **D** 150 m

(ii) At which of these times is the resultant force on Joe bigger than the resultant force on Sam? [1]

Put a cross (☒) in the box next to your answer.

☐ **A** at 3 s

☐ **B** at 7 s

☐ **C** at 11 s

☐ **D** at 15 s

(iii) For how many seconds was Joe accelerating? [1]

Number of seconds = _____ s

(iv) Calculate Joe's acceleration during this time. [2]

Joe's acceleration = _____ m/s^2

b) The diagram shows the horizontal forces acting on Joe at one point while he is accelerating.

(i) Calculate the size of the resultant horizontal force acting on Joe and his bike. [2]

Size of resultant force = _____ N

(ii) The total mass of Joe, his heavy bag, and his bike is 55 kg.

Calculate the total weight. [1]

(Gravitational field strength, g = 10 N/kg)

Total weight = _____ N

c) On another day, Joe is riding the same bike on the same piece of road. This time he does not have the heavy bag on his back. He finds that it is easier to accelerate.

Explain why Joe finds it easier to accelerate. [2]

_____

_____

_____

_____

9. A star with a mass very much larger than the Sun [1]

☒ **A** has a longer main sequence life than the Sun and ends as a white dwarf.

☒ **B** has a longer main sequence life than the Sun and ends as a black hole.

☒ **C** has a shorter main sequence life than the Sun and ends as a white dwarf.

☒ **D** has a shorter main sequence life than the Sun and ends as a black hole.

10. Complete the sentence by putting a cross (☒) in the box next to your answer. [1]

A student correctly estimated the length of a bee.

The length of a bee is about 2.0

☐ **A** mm

☐ **B** cm

☐ **C** m

☐ **D** km

11. A student is investigating a filament lamp.

a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer. [1]

The current in the filament lamp is a flow of

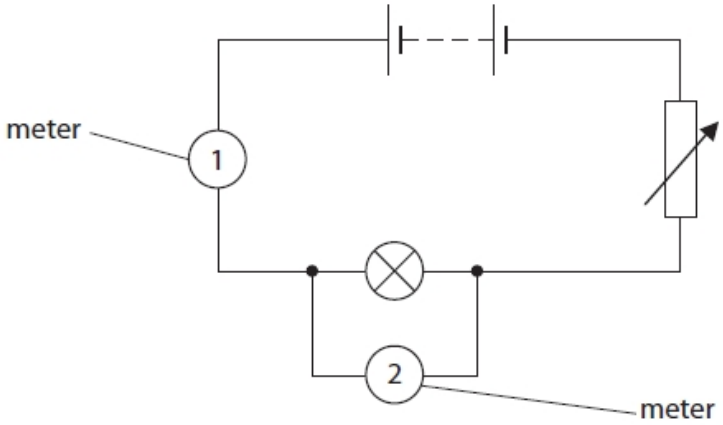
☐ **A** protons

☐ **B** neutrons

☐ **C** electrons

☐ **D** atoms

(ii) The student uses this circuit in his investigation.



State what is measured by the meters. [2]

Meter 1 measures

_____

Meter 2 measures

_____

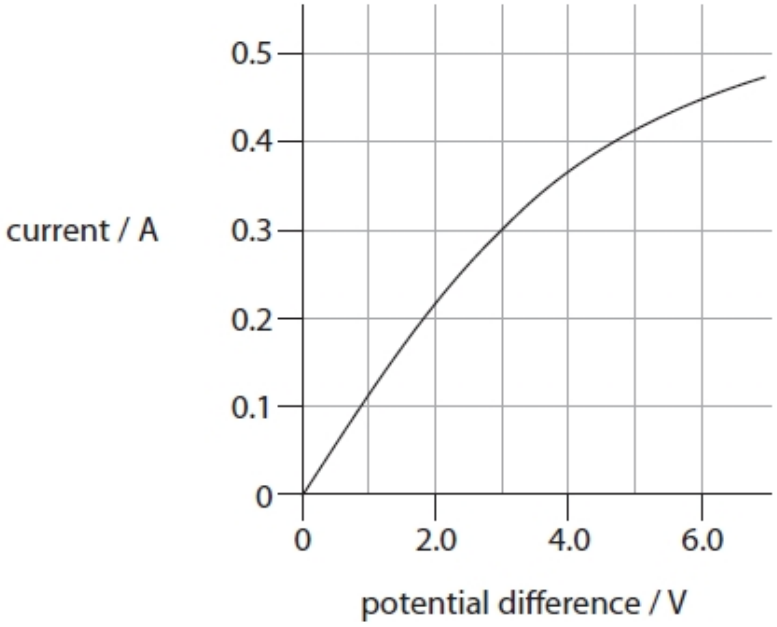
b) The normal operating voltage and current of the filament lamp is 6 V, 0.4 A.

Calculate the energy supplied to the lamp under these conditions in 20 seconds. [2]

(E = V x I x t)

Energy = _____ J

c) The graph shows how current varies with potential difference (voltage) for another filament lamp.



Calculate the resistance of the lamp when the current in the lamp is 0.3 A. [3]

Resistance = potential difference ÷ current ($R = V / I$)

Resistance = _____ Ω

Total for Section A: 60 marks

Section B

Answer ONE question in this section, 1, 2 or 3.

BIOLOGY

1. A student wanted to investigate the effect of different colours of light on the rate of photosynthesis by measuring the number of bubbles of gas given off.

   The results are shown in the table below. No bubbles of gas were given off in the dark.

Colour of light	Time in seconds to release 20 bubbles
Violet	60
Blue	40
Blue-green	60
Green	125
Yellow	95
Orange-red	50

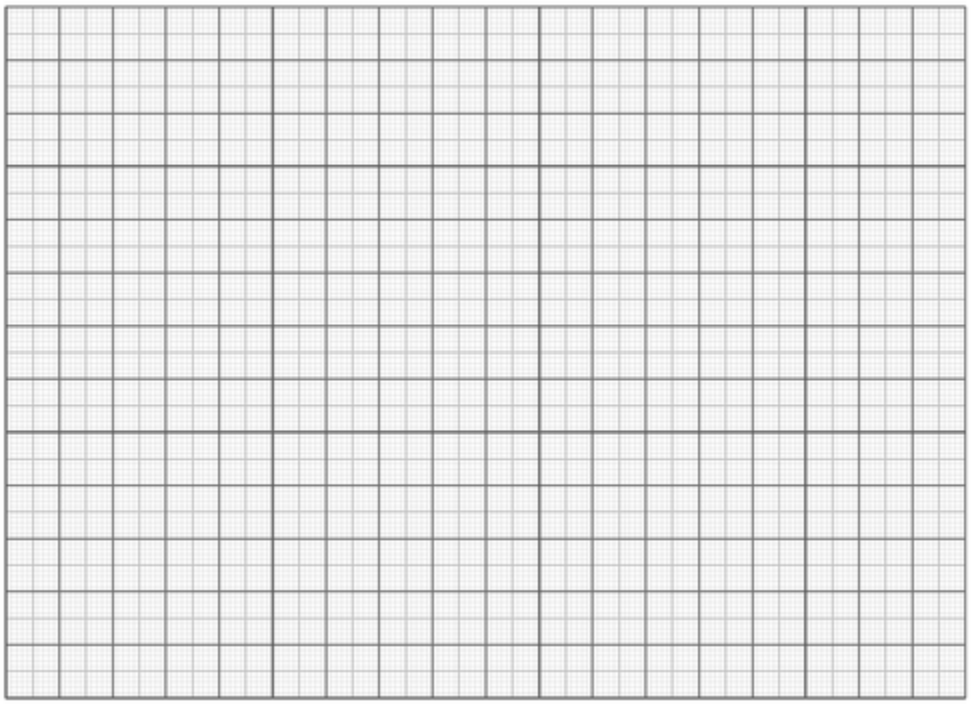
a) Name the gas given off in the bubbles. [1]

_____

e) Name the gas that is used in the process of photosynthesis. [1]

_____

c) (i) Plot a bar chart using the graph paper below to show these results. [4]



(ii) What colour of light in this experiment produced bubbles fastest? [1]

_____

(iii) Algae grow on the side of glass fish tanks in daylight. What colour light would result in the slowest growth of algae? [1]

_____

d) Suggest another method which does not involve the counting of bubbles to measure the rate of gas production. [2]

_____

_____

_____

_____

_____

Total: 10 marks

2. This question is about quarrying for iron ore.

A quarrying company uses explosives to blast rock from a cliff face. After the rock has been blasted from the quarry face, the rubble comprises:

- Small iron filings (max dimension 2 mm)
- Large chunks of iron ore (max dimension 200 mm)
- Medium-sized pieces of the mineral halite (a form of the salt sodium chloride – max dimension 50 mm)
- Sand (max dimension 0.5 mm)

The company wishes to separate the iron ore from the mixture as well as sell bags of the remaining components in a **pure and dry** form.

You are an engineer tasked by the quarrying company to design a device that will enable the company to separate the individual components of a mixture collected from their quarries.

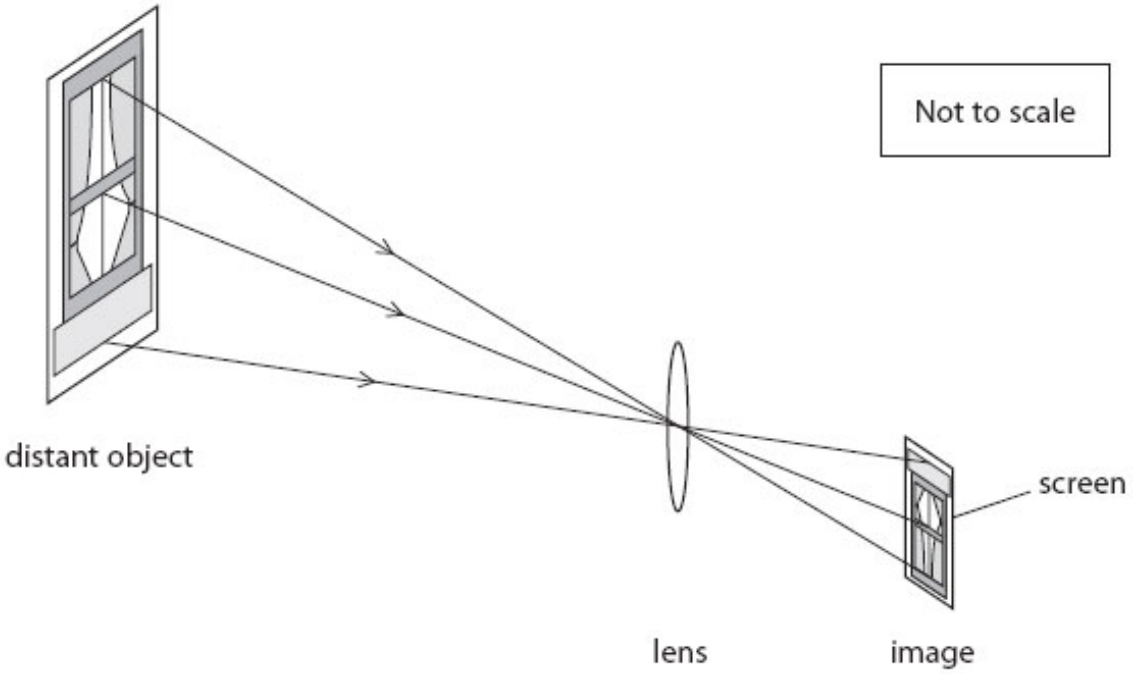
Design a machine that could separate each component of the mixture from the others producing **pure, dry** samples of each component.

Your answer should include:

- A description of the separation techniques used
- An explanation of how the properties of the substances allow them to be separated
- Appropriate scientific terminology

Total: 10 marks

3. A lens can be used to produce a clear image of a distant object on a screen.



a) (i) Complete the sentence by circling your answer. [1]

The image produced is real because it is

A in focus

B magnified

C on a screen

D smaller

(ii) Describe how to measure the focal length of the lens. [2]

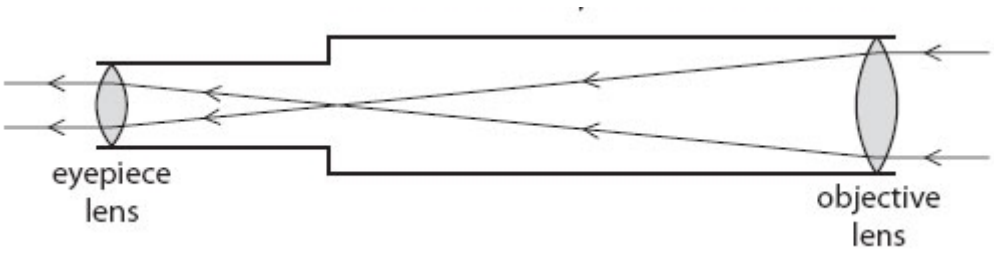
_____

_____

_____

_____

b) The diagram shows a simple telescope which uses two lenses to look at stars.



(i) Explain what the eyepiece lens does. [2]

_____

_____

(ii) Complete the sentence by circling your answer. [1]

The light that travels from the stars transfers

A charge

B energy

C mass

D matter

c) Light and sound waves are produced at the same time by an explosion on Earth.

(i) The sound of the explosion is heard 1920 metres away 6.0 seconds after the explosion has happened.

Calculate the speed of sound in air. [2]

_____ m/s

(ii) A scientist is standing a long way from the explosion.

Explain why he hears the explosion a few seconds after he sees it. [2]

_____

_____

_____

Total: 10 marks