

**Department of Education**  
**National Secondary Education Examinations**

**SCIENCE**  
Time allowed: 1 hour 30 minutes

Centre Number	
Candidate Number	

**Materials**

You will need:

- a pen (black ink only)
- a calculator

**Instructions**

- Fill the boxes above clearly in black ink.
- Answer all the questions.
- Show all your working out.
- Do not write outside the box.
- Do not write over the barcodes.
- **Do not turn over until told to do so by an invigilator.**

**Information**

- This paper has 12 pages.
- The total mark for this paper is 100.
- The marks for each question are shown in brackets [ ].
- If additional space is required, please ask an invigilator for an additional answer booklet.

Examiner's use only	
Question	Mark
1	/ 4
2	/ 8
3	/ 6
4	/ 8
5	/ 5
6	/ 4
7	/ 5
8	/ 4
9	/ 6
10	/ 8
11	/ 6
12	/ 4
13	/ 8
14	/ 6
15	/ 6
16	/ 9
17	/ 3
<b>TOTAL</b>	<b>/ 100</b>



**1** Bacterial and fungal cells are examples of cells with cell walls.

a) Name another cell which has a cell wall. [1]

\_\_\_\_\_

b) Name one other structure that can be found in bacterial and fungal cells. [1]

\_\_\_\_\_

c) Give a difference between bacterial and plant cells. [1]

\_\_\_\_\_

d) A plant cell is around 50 micrometres in size. A bacterial cell is around 0.8 micrometres in size. How many times bigger is a plant cell compared to a bacterial cell? [1]

\_\_\_\_\_

**The total for Question 1 is 4 marks.**

**2** Plants have many specialised transport systems.

a) Mineral ions move from the soil to the root cells. The concentration of these ions is lower in the soil than in the root cells. What method does a plant use to transport mineral ions into the root cells? [1]

\_\_\_\_\_

b) How does this work? [2]

\_\_\_\_\_

\_\_\_\_\_

c) How does water enter a plant? [3]

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

d) When water enters a plant cell, the vacuole swells and fills until no more water can enter.

The plant cell has become \_\_\_\_\_ [1]

e) What structure does a plant use to transport water throughout the plant? [1]

\_\_\_\_\_

**The total for Question 2 is 8 marks.**



**3** DNA is a protein.

**a)** What are proteins made of? **[1]**

\_\_\_\_\_

**b)** Part of the base sequence in DNA is shown below.

T C G G A C T C A

What is the complementary strand for this part of the DNA? **[1]**

\_\_\_\_\_

**c)** What are the names of the four nucleotides found in DNA? **[2]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**d)** How is DNA arranged in a prokaryotic cell? **[2]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**The total for Question 3 is 6 marks.**

**4** Farmers may sometimes clone animals.

**a)** Why may they choose to do this? **[1]**

\_\_\_\_\_

\_\_\_\_\_

**b)** How is animal cloning achieved? **[4]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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- c) Cloning is also important to produce the hormone insulin. In the past, insulin from the pancreases of animals were used. Now, bacteria are used to produce it.

How is using bacteria advantageous? [3]

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**The total for Question 4 is 8 marks.**

- 5** There are different types of respiration.

- a) Name the type of respiration carried out in humans which yields the most ATP per glucose molecule. [1]

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- b) A cardiac muscle has more mitochondria than a skeletal muscle. Why is this? [1]

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- c) How is oxygen debt paid? [2]

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- d) Yeast can undergo different types of respiration. A certain type is used for producing alcohol.

What is the equation for this type of respiration in yeast? [1]

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**The total for Question 5 is 5 marks.**

- 6** Chlorine exists as diatomic molecules.

- a) There are different isotopes of chlorine. What is an isotope? [1]

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**b) What is the most common isotope of chlorine? [1]**

\_\_\_\_\_

**c) Name an element which has similar chemical properties to chlorine. [1]**

\_\_\_\_\_

**d) How many protons and electrons does a chlorine ion have? [1]**

Protons: \_\_\_\_\_

Electrons: \_\_\_\_\_

**The total for Question 6 is 4 marks.**

**7** The atom is an important discovery in science.

**a) Describe J. J. Thompson's model of the atom. [2]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**b) Some atoms form ions. What is an ion? [1]**

\_\_\_\_\_

\_\_\_\_\_

**c) Elements are arranged into groups and periods in the periodic table.  
State how the properties of an atom determine its position in the periodic table. [1]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**d) Two or more non-metallic atoms may bond.  
State and describe the type of bonding they use. [1]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**The total for Question 7 is 5 marks.**

8 Organic compounds are widely used in industry.

a) What is meant by an organic compound? [1]

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b) Organic compounds have functional groups. What is a functional group? [1]

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c) What type of reaction is undertaken when monomers join to form a polymer? [1]

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d) In the space below, draw three butanoic acid monomers joined together. [1]

**The total for Question 8 is 4 marks.**

9 A student carried out an investigation into the reaction of dilute hydrochloric acid and calcium carbonate. The reaction produces a gas and the student wanted to measure how long it takes for 50 cm<sup>3</sup> of gas to be collected.

a) Write a balanced symbol equation (with state symbols) for this reaction. [1]

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b) What could the student have used to measure the gas produced? [1]

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c) The student did the experiment twice. Once with lumps of calcium carbonate, and another time with powdered calcium carbonate.

How would the reactions differ, and why? [2]

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d) As the reaction proceeded, the rate of reaction decreased. Why? [1]

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e) The experiment was repeated with sulfuric acid, rather than hydrochloric acid. The time taken for the gas to be collected decreases. Explain why. [1]

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**The total for Question 9 is 6 marks.**

**10** Metal elements make up over three-quarters of the periodic table.

a) What is the name given for metals in Group 1 of the periodic table? [1]

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b) Why are they given this name? [1]

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c) A student has a metallic salt. They want to find out what the metal is. Describe what can the student do. [3]

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d) Why are metals able to conduct electricity? [1]

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e) A pure metal on its own is very soft. Metals are usually used in the form of alloys. Explain what an alloy is, and why it is better to use alloys than pure metals. [2]

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**The total for Question 10 is 8 marks.**

11 Electrolysis is used to separate aluminium from its ore.

a) What is meant by the term 'electrolysis'? [1]

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b) Why must a DC power supply be used for electrolysis? [1]

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c) Why do ionic compounds like aluminium oxide conduct electricity when molten or dissolved, but not when solid? [1]

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d) Aluminium oxide's melting point is too high. What must be added to lower the melting point? [1]

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e) Write the two half equations of the reactions which take place at the cathode and anode during the electrolysis of aluminium oxide. [2]

Anode: \_\_\_\_\_  
Cathode: \_\_\_\_\_

**The total for Question 11 is 6 marks.**

12 A large part of Basiland is powered by renewable source of energy. A large wind farm, consisting of 150 wind turbines, produces 60 MW of power. This can power 600,000 homes.

a) How much power is needed for one home? [1]

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Watts

b) Explain why wind turbines cannot be used to power all of Basiland. [2]

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- c) The wind turbines used in the farm are 82% efficient. What is the power input for one wind turbine? [1]

\_\_\_\_\_ Watts

**The total for Question 12 is 4 marks.**

**13** The Government is thinking of mandating the use of electric cars.

- a) What two factors affect how far an electric car can travel before it needs to be recharged? [2]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- b) The maximum acceleration for a car is  $25 \text{ m/s}^2$ . Calculate how long it takes for a car to go from 0 m/s to 50 m/s using its maximum acceleration. [1]

\_\_\_\_\_ seconds

- c) The maximum speed for a car is 50 m/s. The air resistance acting on the car when it is travelling at this speed is 4000 N. Calculate the work done against air resistance when the car travels for 5 minutes at its maximum speed. [1]

\_\_\_\_\_ joules

- d) The braking distance of the car increases as the speed increases. What two other factors affect the braking distance of the car? [2]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- e) Speed cameras work by finding the time taken for a car to travel between two points and working out the car's speed. The car passes two points which are 12.75 metres apart in 2.25 seconds. What is the speed of the car? [1]

\_\_\_\_\_ metres / second



- f) The speed limit in the area was 5 metres / second. Was the car breaking the speed limit? [1]

\_\_\_\_\_

**The total for Question 13 is 8 marks.**

**14** Hailstones are small balls of ice formed in clouds.

- a) When a hailstone falls from the cloud, it initially accelerates. Why? [1]

\_\_\_\_\_  
\_\_\_\_\_

- b) The hailstone soon stops accelerating and reaches its terminal velocity. Why? [2]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- c) The hailstone initially had 3 kJ of gravitational potential energy in the cloud, and weighs 25g. What is the maximum possible velocity of the hailstone? [1]

\_\_\_\_\_ metres / second

- d) If the gravitational field strength was 9.8 N / kg. How high was the hailstone to start with? [1]

\_\_\_\_\_ kilometres

- e) Why is the hailstone unable to achieve its maximum possible velocity? [1]

\_\_\_\_\_  
\_\_\_\_\_

**The total for Question 14 is 6 marks.**

**15** An electric circuit has many components. Resistors help to slow down the flow of current.

- a) Which of the two resistors below will allow the greatest amount of current to pass? [1]

Resistor A's rating: 10W, 16 Ohms.  
Resistor B's rating: 8W, 4 Ohms.

\_\_\_\_\_

**b)** The electric circuit also has a fuse. How does a fuse work? **[1]**

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**c)** When lawnmowing, it is recommended to connect the lawnmower to a residual current circuit breaker (RCCB) during use.

What electrical dangers does a lawnmower present during use, and why? **[1]**

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**d)** What are two differences between a fuse and an RCCB? **[2]**

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**e)** Why is an RCCB recommended, even though a fuse is present in the plug of the lawnmower? **[1]**

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**The total for Question 15 is 6 marks.**

**16** The National Grid is a system of power cables and transformers.

**a)** What are the three parts of a transformer? **[2]**

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**b)** The transformer does not work with DC current. Explain why. **[1]**

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**c)** The transformer has 200 turns on the input side, and 1200 turns on the output side. The input potential difference is 230 V. Determine the output potential difference. **[1]**

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d) Explain how the transformer works, and how it produces the output potential difference. [2]

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e) Fill in the gaps. [1]  
Before transmission, \_\_\_\_\_ transformers are used to increase the voltage.  
Before reaching homes, \_\_\_\_\_ transformers are used to decrease the voltage.

f) Why is the potential difference increased before transmission, and decreased before it reaches homes? [2]

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The total for Question 16 is 9 marks.

17 Diving bricks sink to the bottom of a pool. They are used to train divers.

a) Explain how the forces on the brick at the bottom of the pool cause the brick to be stationary. [1]

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b) A diving brick is 25 cm long, 10 cm wide and 10 cm high. When the brick is at the bottom of the pool, the top surface of the brick is 2.50 metres below the surface of the water. The force acting on the top surface of the brick due to the weight of the water is 637 N, and the gravitational field strength is 9.8 N / kg.

Calculate the density of the water. [2]

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kg / m<sup>3</sup>

The total for Question 17 is 3 marks.

END OF PAPER  
Total mark: 100

