Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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1316983031

CO-ORDINATED SCIENCES **0654/31**

Paper 3 Theory (Core) **May/June 2019**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 28.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **26** printed pages and **2** blank pages.

Cambridge Assessment International Education

[Turn over

1 **(a)** Fig. 1.1 is a diagram of a plant cell.

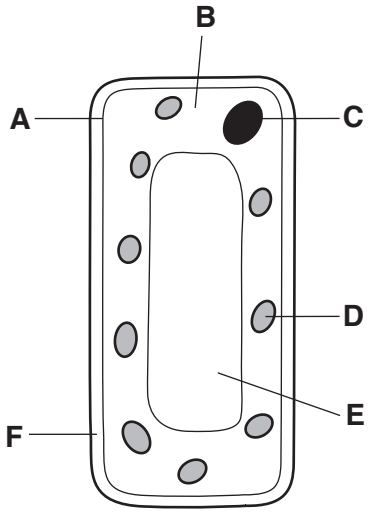


Fig. 1.1

Table 1.1 shows some of the parts labelled in Fig. 1.1.

Use Fig. 1.1. to complete Table 1.1.

Table 1.1

name of part	letter in Fig. 1.1	function
	A	controls what enters and leaves the cell
		site of photosynthesis
		stops cell from bursting
nucleus		contains genetic material

[4]

(b) Carbon dioxide is one of the raw materials needed for photosynthesis.

(i) State **one other** raw material needed for photosynthesis.

..... [1]

(ii) Describe how carbon dioxide moves into cells.

Include the name of the process in your answer.

.....

.....

.....

..... [3]

[Total: 8]

2 Chlorine and argon are gaseous elements in Period 3 of the Periodic Table.

(a) State **one** use of chlorine.

use of chlorine .....

..... [1]

(b) An argon atom contains 18 electrons.

(i) State the electronic structure of argon.

..... [1]

(ii) State, in terms of electronic structure of atoms, why argon is unreactive.

.....

..... [1]

(iii) Information about the atomic structure of a particle **J** is shown below.

number of protons in the nucleus	17
electronic structure	2,8,8

Explain why particle **J** is a **negative** chloride ion.

.....

.....

.....

..... [2]

(c) Chlorine, Cl_2, combines with hydrogen, H_2, to form hydrogen chloride, HCl.

(i) Balance the symbol equation for this reaction.

$$Cl_2 \quad + \quad H_2 \quad \rightarrow \quad HCl$$ [1]

(ii) Fig. 2.1 shows the covalent bond in a molecule of hydrogen chloride.

Fig. 2.1

State the number of electrons in this bond.

..... [1]

[Total: 7]

[Turn over

3 **(a)** A shower is connected to an electrical pump to increase the flow of water.

Fig. 3.1 shows an incomplete circuit diagram for the shower pump.

(i) Complete Fig. 3.1 by adding a switch and two resistors all in series with the power supply and motor.

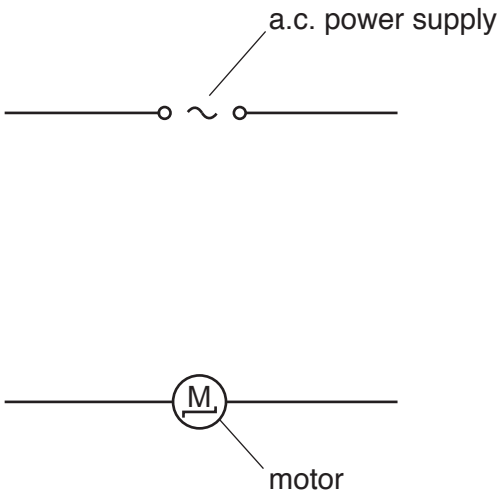


Fig. 3.1

[3]

(ii) The two resistors in the pump circuit have values of 4 Ω and 6 Ω.

Calculate the combined resistance of the two resistors in series.

resistance = ... Ω [1]

(iii) The potential difference across the resistors is 50 volts. Use your answer to **(a)(ii)** to calculate the current in the circuit.

Show your working.

current = ... A [2]

(iv) An electrician measures the current in the circuit. Describe how the ammeter is connected to measure the current.

.....

..... [1]

(v) Draw the symbol for an ammeter.

[1]

(b) A boy combs his hair while looking in a plane mirror. He notices the reflection of a spider in the mirror.

(i) Write the letter **X** on Fig. 3.2 to show the position of the image of the spider.

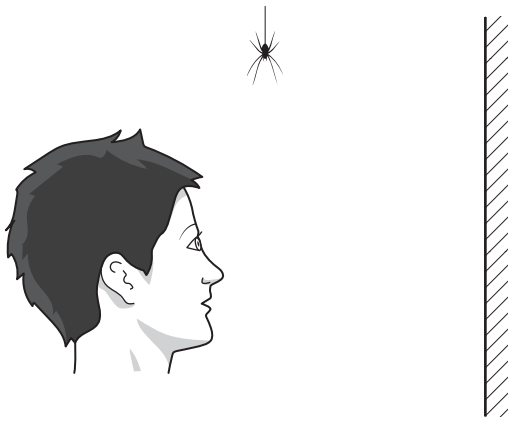


Fig. 3.2

[1]

(ii) Circle the two correct words or phrases that describe the image of the spider in the mirror.

diminished **enlarged** **laterally inverted**

same size **upside down**

[2]

(iii) On Fig. 3.2, draw the path of a ray of light from the spider to show how the student can see the spider in the mirror. [2]

[Total: 13]

4 **(a)** The menstrual cycle of females can vary from approximately 24 to 32 days.

Fig. 4.1 is a diagram which represents the menstrual cycle for one female.

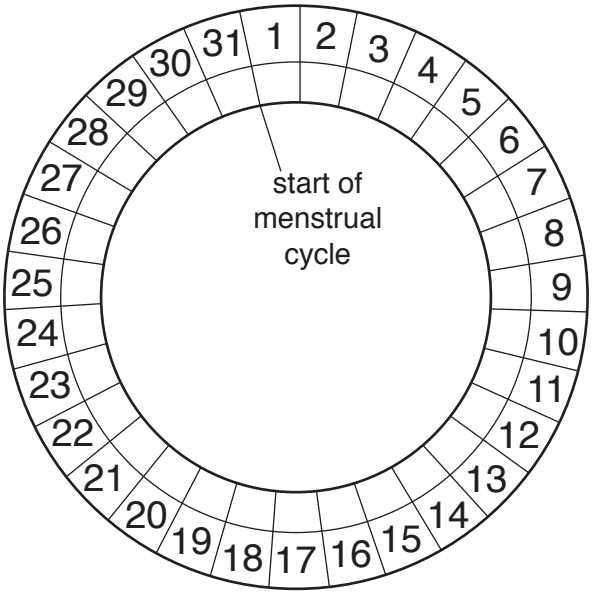


Fig. 4.1

(i) State the number of days of the menstrual cycle shown in Fig. 4.1.

..... [1]

(ii) Menstruation is the breakdown and loss of the uterus lining.

Place ticks (✓) in the boxes on Fig. 4.1 to show on which days menstruation occurs. [1]

(iii) Place a cross (✘) in **one** box on Fig. 4.1 to show when ovulation occurs. [1]

(b) Describe the changes that occur to the uterus lining after menstruation.

.....

.....

..... [2]

(c) Complete the sentences about fertilisation using words from the list.

Each word or phrase may be used once, more than once or not at all.

baby **nuclei** **ovaries** **ovum**

placenta **zygote**

The sperm meets the ..... in the oviduct.

Fertilisation is the fusion of the two ..... .

Fusion results in the formation of a single cell called a ..... .

[3]

(d) Sperm cells pass through several parts of the female reproductive system before fertilisation occurs in the oviduct.

Name **two** of these parts.

1 .....

2 .....

[2]

[Total: 10]

5 Sulfur dioxide and ammonia are gaseous compounds.

(a) Sulfur dioxide is released when fossil fuels burn.

(i) Name **two** fossil fuels.

1 .....

2 .....
[2]

(ii) Explain why burning fossil fuels releases sulfur dioxide.

.....

.....

..... [2]

(iii) The pH of water is 7.

When sulfur dioxide dissolves in water, the pH changes to 2.

Explain this observation.

.....

..... [1]

(iv) Describe **one** way that sulfur dioxide can damage the environment.

.....

.....

..... [2]

(b) **(i)** State the chemical formula of ammonia.

..... [1]

(ii) Ammonia and sulfur dioxide are used in the production of ammonium sulfate.

Explain why ammonium sulfate is added to soil used to grow crops.

.....

.....

..... [2]

[Total: 10]

6 **(a)** A boy travels in an elevator from the ground floor of an apartment building. He goes up to the 10th floor.

Fig. 6.1 shows a speed-time graph of the elevator.

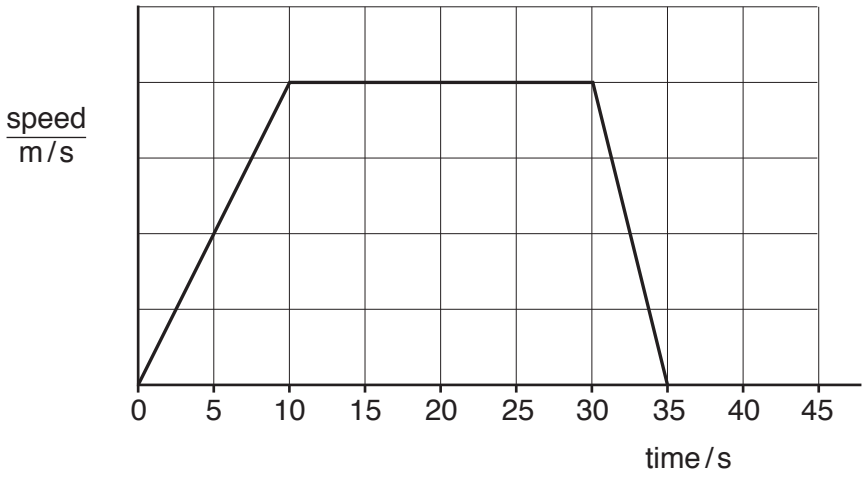


Fig. 6.1

(i) The elevator travels 30 m upwards and stops.

Calculate the average speed of the elevator as it travelled upwards.

Show your working.

average speed = ... m/s [2]

(ii) Use Fig. 6.1 to find the length of time the elevator travels at a constant speed.

time = ... seconds [1]

(b) The boy makes a telephone call on his mobile phone (cell phone).

The mobile phone screen provides information using visible light and it transmits conversations using microwaves.

(i) Write **microwaves** and **visible light** in their correct positions in the electromagnetic spectrum in Fig. 6.2.

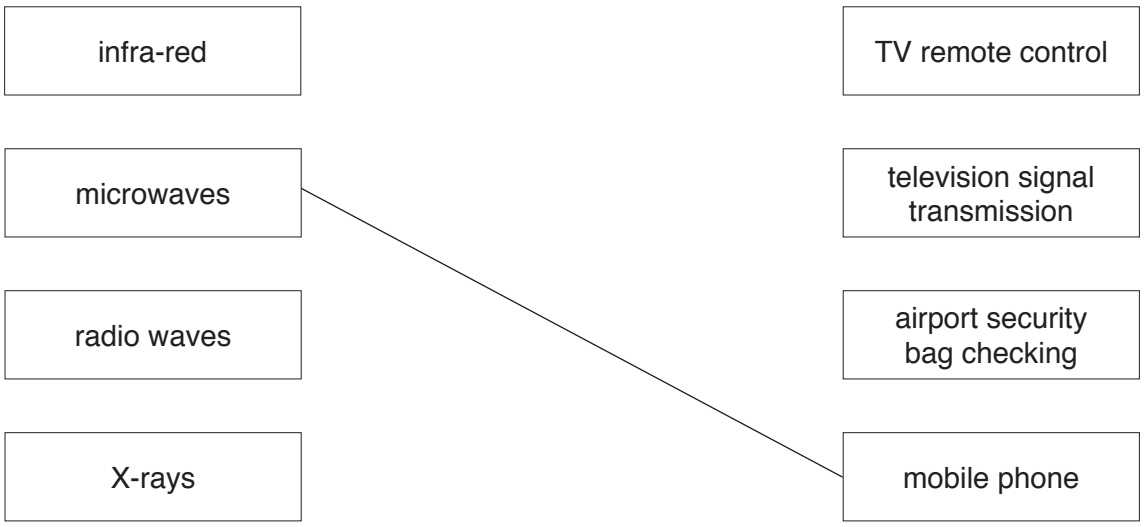
gamma rays		ultraviolet				radio waves

Fig. 6.2

[2]

(ii) Draw a line from each type of electromagnetic radiation to its use.

One of the lines has been drawn for you.



[2]

(c) The mobile phone case uses a magnet and a strip of steel within the case to keep it closed.

Describe how the magnet and the steel strip keeps the phone case closed.

..... [1]

[Total: 8]

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7 The graph in Fig. 7.1 shows the effect of temperature on the rate of transpiration through a leaf.

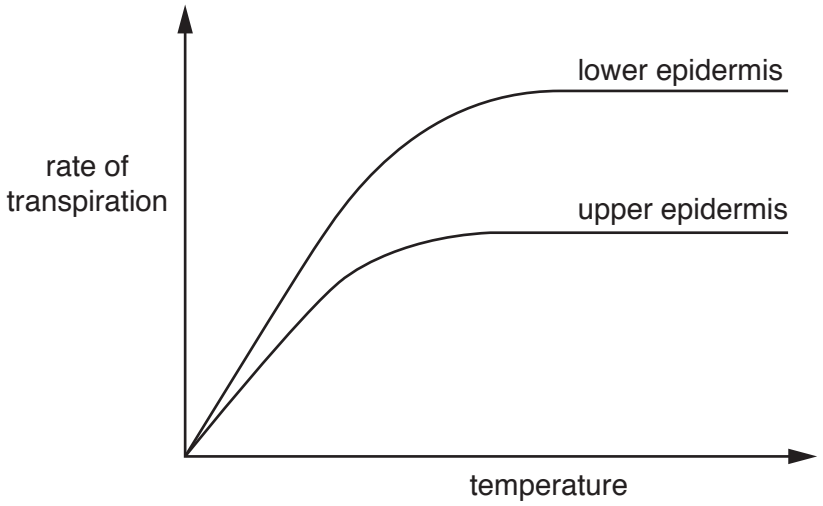

Fig. 7.1

(a) Describe the trends shown in Fig. 7.1.

.....

.....

.....

..... [2]

(b) Water vapour is lost through the stomata during transpiration.

Suggest a reason for the difference between the rate of transpiration in the upper and lower epidermis.

.....

..... [1]

(c) Complete the graph in Fig. 7.2 to show the effect of humidity on the rate of transpiration.

Include on your graph:

- labels for both axes
- a sketch of a suitable line.

Fig. 7.2

[2]

(d) The words in the list are parts of a plant through which water travels.

Write the words in the correct order to show the pathway of water through the plant.

One has been done for you.

mesophyll cells **root cortex cells** **root hair cells**

~~**stomata**~~ **xylem**

.....

.....

.....

.....

stomata

pathway of water

[2]

[Total: 7]

8 Most elements in the Periodic Table are metals.

(a) State a **physical** test and the result which shows that a solid has a metallic property.

physical test .....

.....

result .....

.....

[2]

(b) **(i)** State the term used for a mixture of metals.

..... [1]

(ii) Table 8.1 shows the melting temperatures of solid **X** and solid **Z**.

Table 8.1

solid	melting temperature / °C
X	327
Z	183 to 250

Use the information in Table 8.1 to decide whether solid **X** and solid **Z** are mixtures of metals or pure metals.

Explain your answers.

X is .....

Z is .....

explanation .....

.....

.....

[2]

(c) The elements below are listed in order of reactivity.

calcium (most reactive)
aluminium
carbon
iron
copper (least reactive)

Fig. 8.1 shows apparatus a student uses to investigate the reaction between powdered carbon and powdered copper oxide.

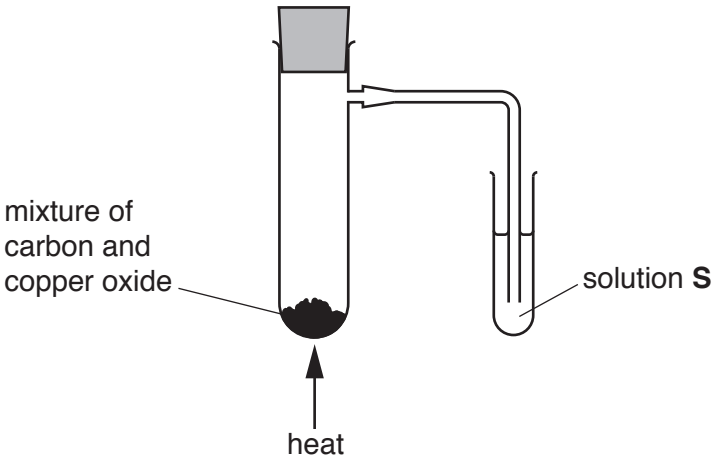

Fig. 8.1

When the student heats carbon with copper oxide, a gas bubbles through solution **S**.

Solution **S** turns cloudy.

(i) State the name of the gas given off and deduce the identity of solution **S**.

gas .....

solution **S** .....
[2]

(ii) Identify the type of chemical reaction that occurs between carbon and copper oxide.

Explain your answer.

type of reaction .....

explanation .....

.....
[2]

(iii) When carbon is heated with calcium oxide, no reaction occurs.

Explain this observation.

.....

..... [1]

(d) (i) Name an ore from which aluminium is extracted.

..... [1]

(ii) State **one** reason, other than cost, why aluminium is recycled.

.....

..... [1]

[Total: 12]

9 **(a)** Fig. 9.1 shows a teacher using a photocopier.

Fig. 9.1

Complete the sentences to describe how a photocopier works.

Electrons are added to a light sensitive plate to give the plate a ..... charge.

To attract ink to the light sensitive plate, the ink powder is given a ..... charge.

This is because ..... charges attract.

[3]

(b) In a thunder cloud the movement of charge creates lightning and thunder together.

A scientist sees the lightning and then hears the thunder 10 seconds later.

(i) The sound travels at 330 m / s.

Calculate how far away she is from the lightning.

Show your working and state the unit

distance = ... unit ..... [3]

(ii) Suggest why the scientist hears the thunder later than she sees the lightning.

.....

..... [1]

(c) The scientist drives away from the thunder storm. The engine of the car provides a horizontal force of 5000 N. The wind from the storm also pushes the car forwards with a force of 500 N.

(i) Calculate the resultant horizontal force acting on the car.

resultant force = ... N [1]

(ii) The wind then changes direction and pushes the car backwards with a force of 500 N.

Calculate the horizontal force the car engine must provide to produce the same resultant force as in **(c)(i)**.

force from car engine = ... N [1]

[Total: 9]

10 (a) The pie chart in Fig. 10.1 shows the proportion of different nutrients contained in a meal.

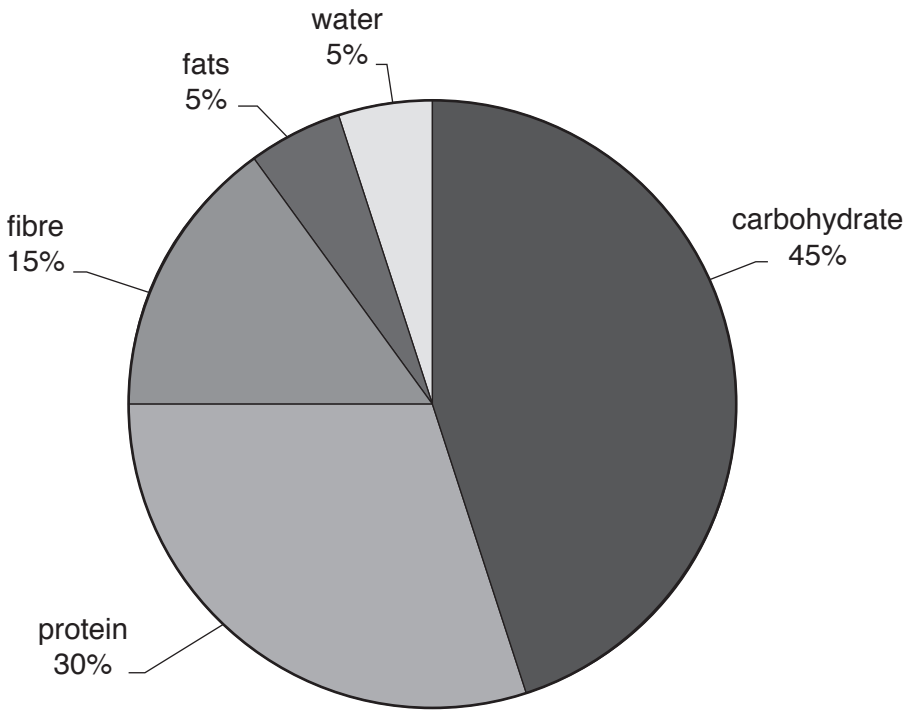

Fig. 10.1

(i) State which nutrient forms the **largest** part of the meal.

..... [1]

(ii) Name the **two** other important types of nutrients that are not shown in Fig. 10.1.

1 .....

2 .....
[2]

(b) The meal contains fats.

Describe the test for fats and the positive result.

test .....

.....

positive result .....
[3]

[Total: 6]

11 Fig. 11.1 shows the structures of four molecules, **A**, **B**, **C** and **D**.

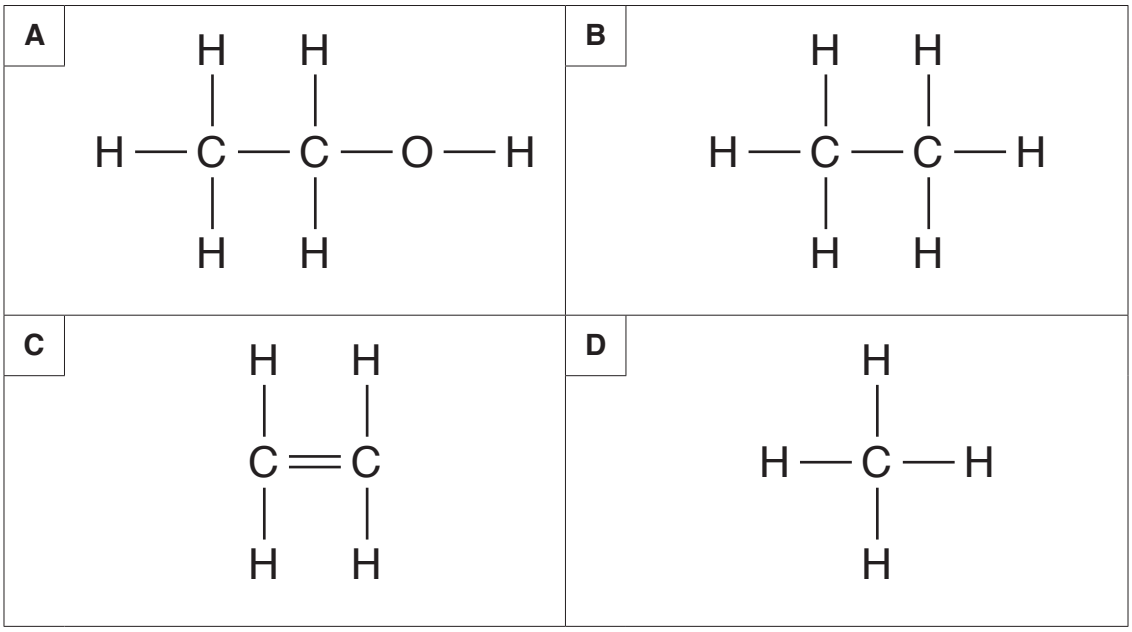

Fig. 11.1

(a) State which of the molecules in Fig. 11.1

are hydrocarbons

.....

are alkanes

.....

is unsaturated

.....

is ethanol.

.....

You may use each letter once, more than once or not at all. [4]

(b) Fig. 11.2 shows apparatus a student uses to investigate the combustion of ethanol.

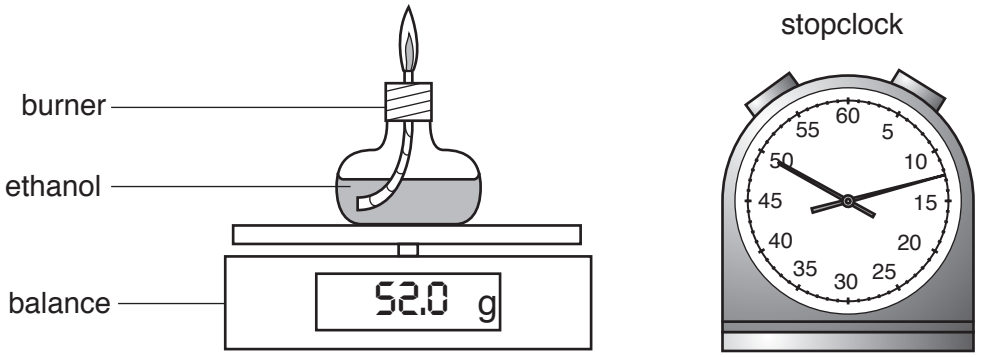

Fig. 11.2

The student records the combined mass of the burner and ethanol.

She lights the burner and starts the stopclock.

She records the balance reading every minute for 15 minutes.

A graph of her results is shown in Fig. 11.3.

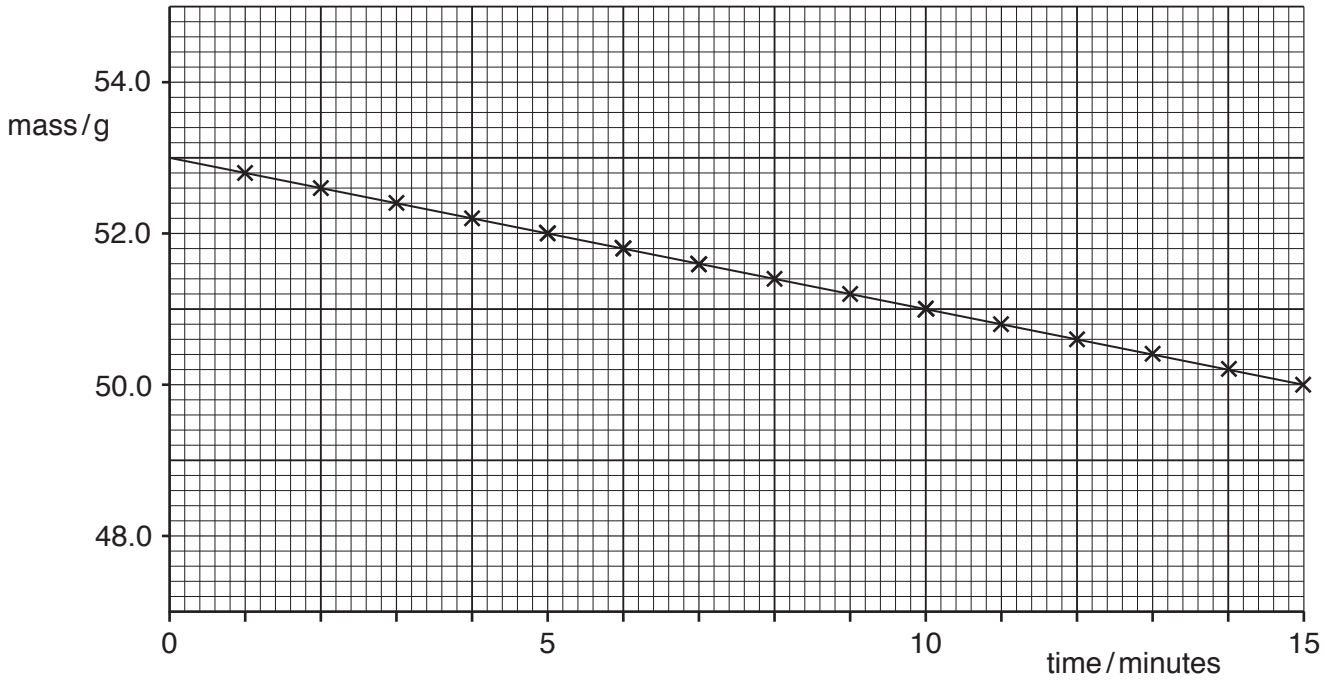

Fig. 11.3

(i) Use the graph to find the change in mass during the experiment.

change in mass = ... g [1]

(ii) Use your answer to **(b)(i)** to calculate the change in mass per minute during the experiment.

rate of change in mass = ... g / min [1]

(iii) Explain why the mass decreases.

.....

.....

..... [2]

(c) (i) Complete the word equation to show two compounds that react to produce ethanol.

[2]

(ii) Ethanol is also made by the action of yeast on glucose.

Name this process.

..... [1]

[Total: 11]

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12 (a) Fig. 12.1 shows a crane used to construct a wind turbine.

The crane lifts a generator and three individual turbine blades.

The generator has a weight of 500 000 N.

Each blade has a weight of 100 000 N.

The crane lifts each item from the ground to a height of 75 m.

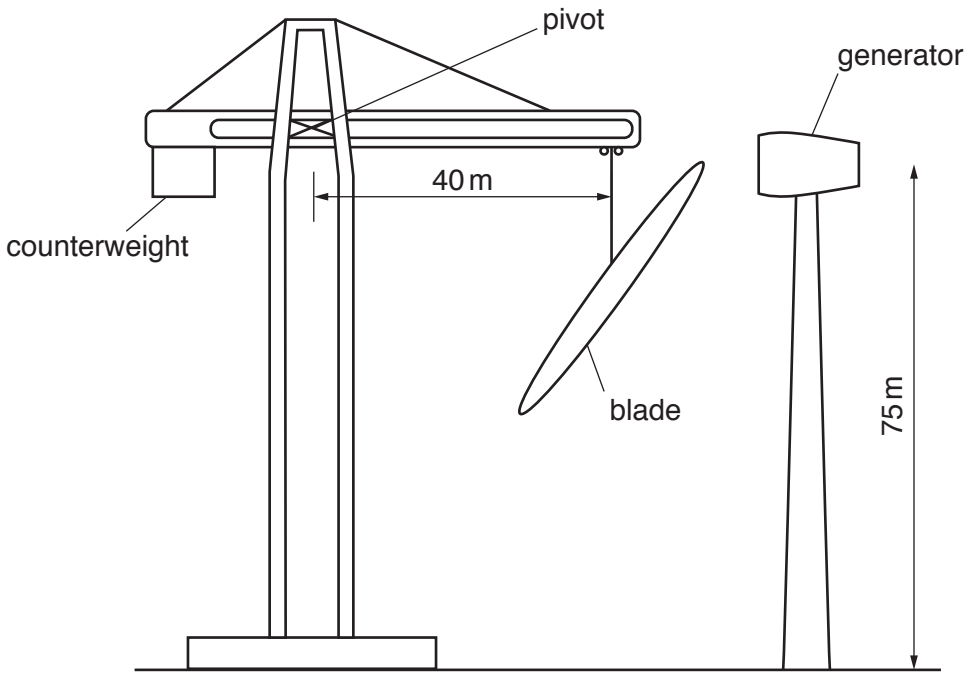


Fig. 12.1

(i) State which part of the turbine requires the crane to do the most work in order to lift the part to a height of 75 m.

Explain your answer.

part .....

explanation .....

.....

[1]

(ii) The crane is lifting a blade.

Calculate the moment of the weight of the blade about the pivot of the crane.

Show your working.

turning moment = ... Nm [2]

(iii) Explain why the counterweight is able to keep this system in equilibrium.

.....

..... [1]

(b) (i) Complete the sequence of energy transfers in a wind turbine.

..... energy of the wind

⟶ ..... kinetic ..... energy of the moving blade and generator

⟶ ..... energy from the generator
[2]

(ii) State **one** advantage and **one** disadvantage of wind turbines as an energy resource.

advantage .....

disadvantage .....
[2]

(c) As the blades of the wind turbine rotate, they produce a low pitch sound. As the wind speed increases, the blades rotate faster and the pitch of the sound increases.

(i) State how the frequency of the sound changes as the blades rotate faster.

..... [1]

(ii) The sound the wind turbine blades make is audible to a healthy human ear.

State the range of audible frequencies for a human ear.

.....Hz [1]

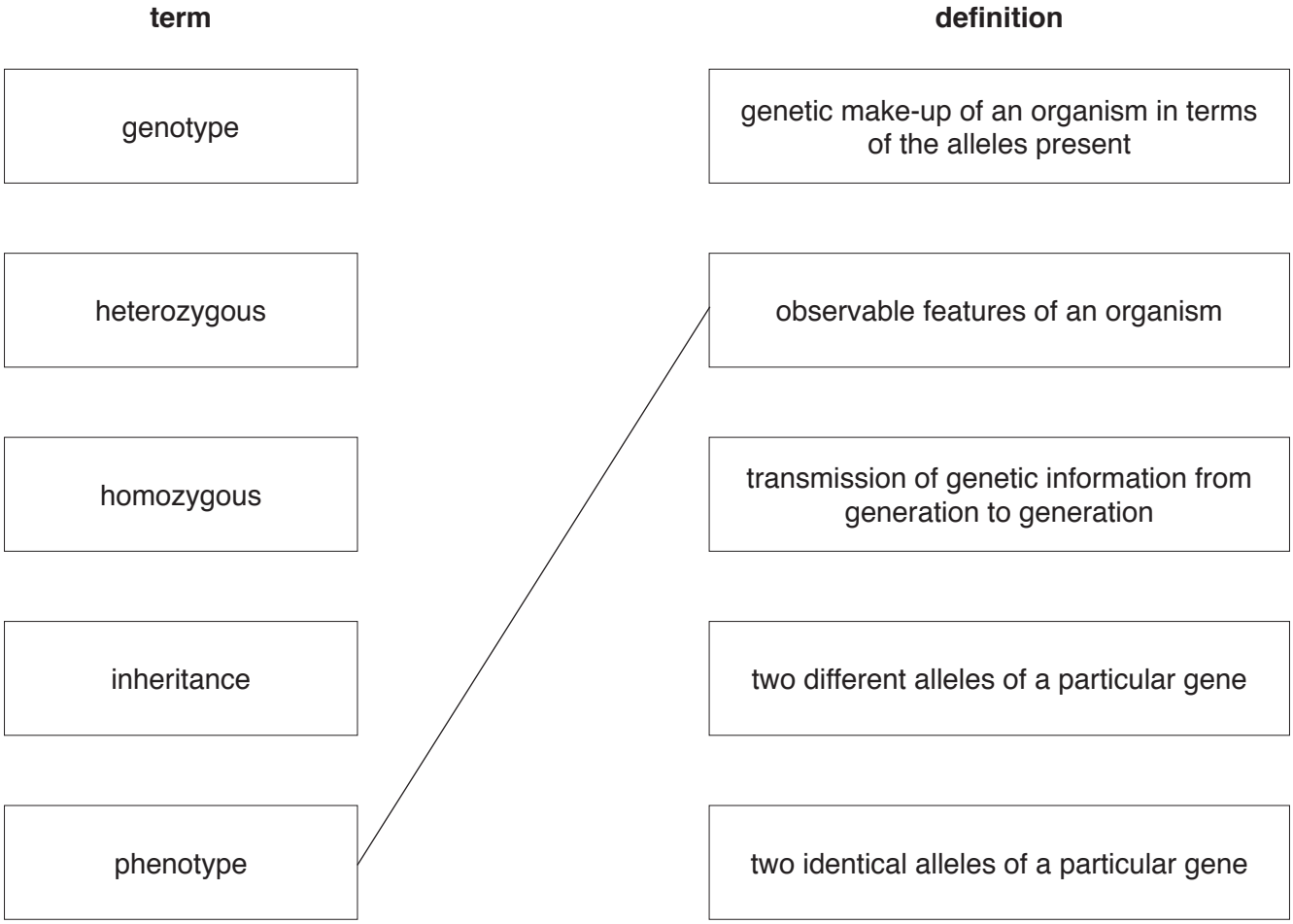
[Total: 10]

13 (a) The boxes on the left show some terms used when describing inheritance.

The boxes on the right show some definitions.

Draw one line from each term to its correct definition.

One has been done for you.



[3]

(b) Table 13.1 shows some of the features of genes and chromosomes.

Place a tick (✓) in the boxes to identify the features of genes and chromosomes.

Table 13.1

	found in nucleus	contains genetic material	codes for a single protein
gene			
chromosome			

[3]

(c) Some chromosomes control the inheritance of sex.

Fig. 13.1 is a genetic diagram to show the inheritance of sex.

Complete Fig. 13.1.

		male gametes	
		X	.....
female gametes	**X**	.....	.....
	.....	.....	.....

phenotypic ratio ..... male : ..... female

Fig. 13.1

[3]

[Total: 9]

The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).