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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 5 7 0 4 2 5 1 2 5 9 *

COMBINED SCIENCE **0653/31**

Paper 3 Theory (Core) **May/June 2026**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen. Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / s^2).

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **24** pages. Any blank pages are indicated.

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[Turn over

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1 **(a)** Figure 1.1 is a diagram of a bacterial cell.

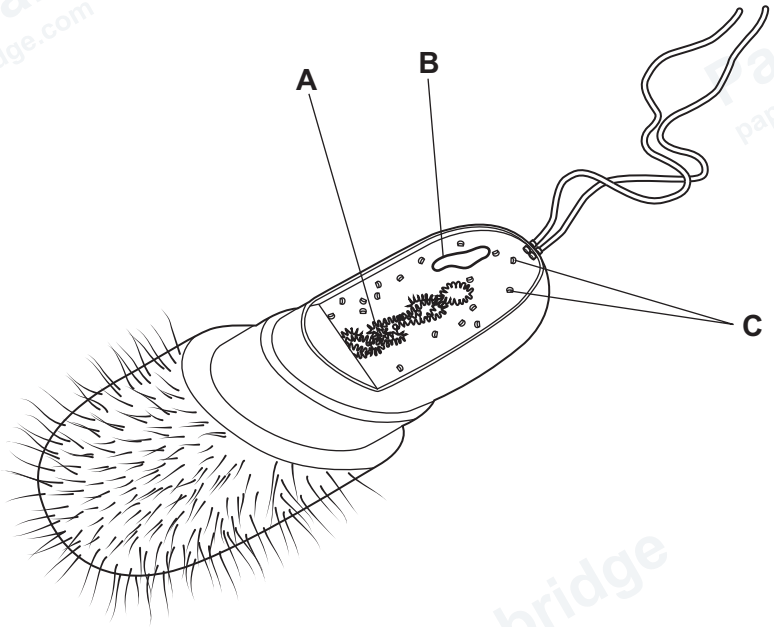


Figure 1.1

(i) Name the structures labelled **A** and **B** in Figure 1.1.

A .....

B .....

[2]

(ii) The structures labelled **C** in Figure 1.1 are also found in animal cells.

State the function of the structures labelled **C** in Figure 1.1.

..... [1]

(iii) State **one** structure present in animal cells that is **not** present in bacterial cells.

..... [1]

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(b) Drugs are used to treat bacterial infections.

Complete the sentences about drugs and bacterial infections.

Choose words from the list.
Each word may be used once, more than once or not at all.

antibiotic **attached** **breakdown**

pathogen **modify** **resistant**

Drugs are any substance taken into the body that ..... or affect chemical reactions in the body.

Bacterial infections are treated using ..... drugs.

The effectiveness of these drugs are reduced when bacteria become ..... to the drugs.

[3]

(c) Blood helps protect the body from bacterial infection by phagocytosis.

State the component of the blood involved in phagocytosis.

..... [1]

[Total: 8]

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2 **(a)** Figure 2.1 is a photograph of a flower.

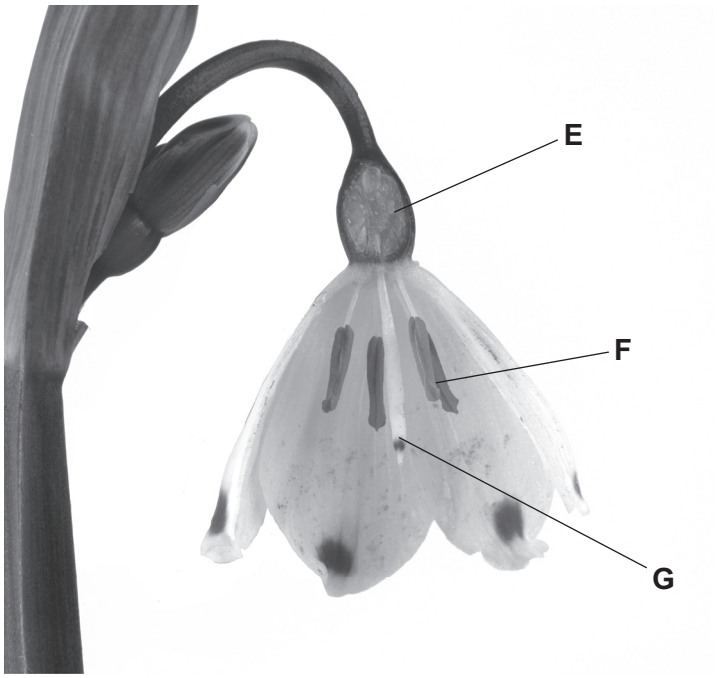


Figure 2.1

The boxes on the left show letters of the parts labelled in Figure 2.1.

The boxes on the right show different functions of the parts labelled in Figure 2.1.

Draw **one** straight line from each part to its function.

part	function
E	produces pollen
F	catches pollen
G	where fertilisation takes place

[2]

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(b) Pollen grains contain the male gametes in flowers.

(i) Name the male gametes in humans.

..... [1]

(ii) Circle the part of the male reproductive system in humans that produces male gametes.

prostate gland **testes** **scrotum** **urethra**

[1]

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(c) Plants are a source of energy for animals.

Figure 2.2 shows part of a food web.

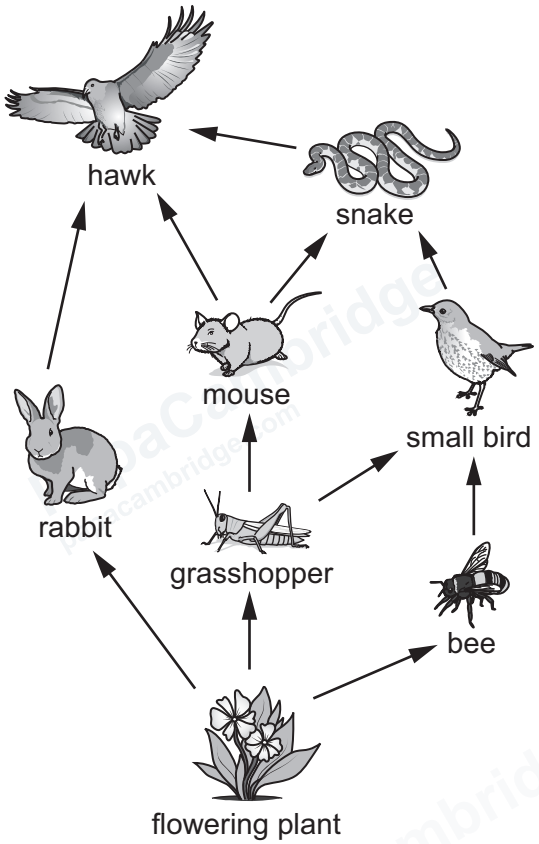


Figure 2.2

(i) Use Figure 2.2 to identify:

one carnivore .....

one tertiary consumer. .....

[2]

(ii) Describe how the mouse gains energy from the flowering plant.

.....

.....

.....

..... [2]

(d) The bee feeds on nectar in flowers. Plants make nectar from glucose and other sugars.

Glucose is used in respiration.

Complete the word equation for respiration.

glucose + ... → ..... + ...

[2]

[Total: 10]

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3 **(a)** Figure 3.1 shows the structure of a plant stem.

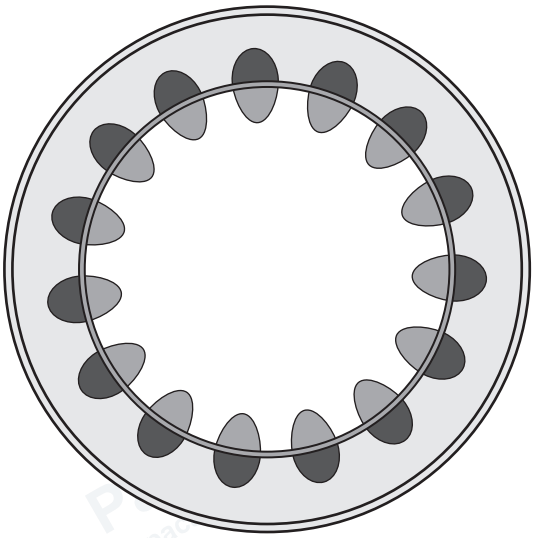


Figure 3.1

(i) Draw a label line and the letter **P** on Figure 3.1 to identify **one** position of phloem. [1]

(ii) Water is transported by xylem vessels and lost as water vapour from leaves.

Circle the word that describes this loss of water vapour from leaves.

evaporation **nutrition** **osmosis** **transpiration**

[1]

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(b) Plants use enzymes in the process of photosynthesis.

(i) Describe what is meant by an enzyme.

.....

.....

..... [2]

(ii) Figure 3.2 is a graph showing the effect of temperature on enzyme activity.

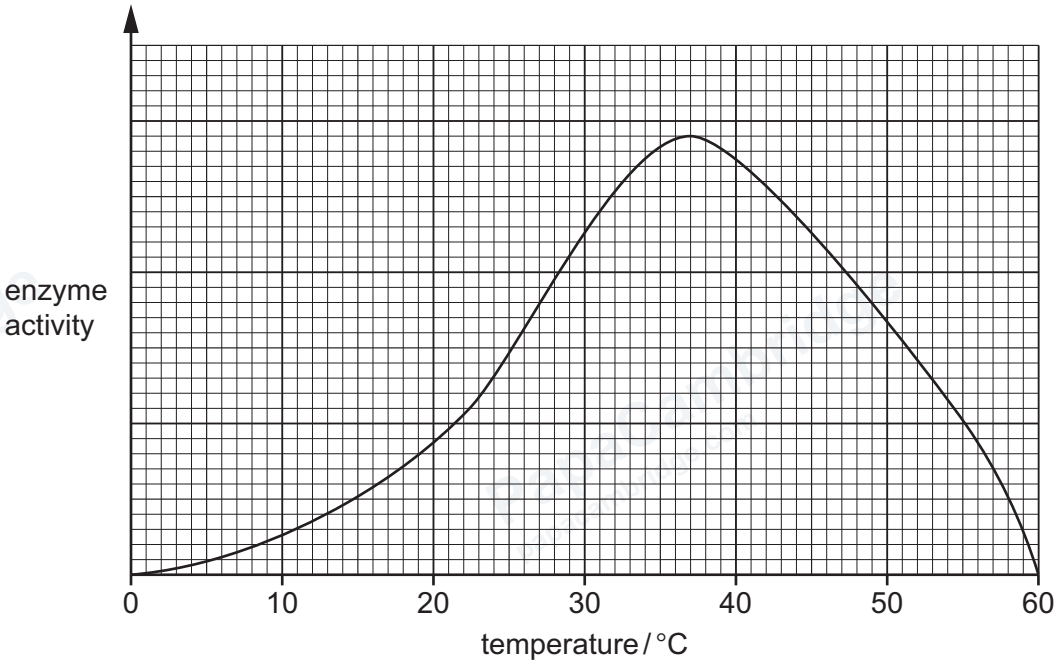


Figure 3.2

Describe the effect of temperature on the enzyme activity shown in Figure 3.2.

Include data in your answer.

.....

.....

..... [2]

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(c) Plants are important parts of ecosystems.

(i) Place a tick (✓) in the box that describes an ecosystem.

An area containing different groups of organisms.	
A unit containing the community of organisms and their environment, interacting together.	
The flow of energy through living organisms.	
The number of different species that live in an area.	

[1]

(ii) Ecosystems are affected by habitat destruction.

State **two** reasons for habitat destruction.

1 .....

2 .....

[2]

[Total: 9]

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4 Atoms contain protons, neutrons and electrons.

(a) Complete Table 4.1 about these particles.

Table 4.1

particle	relative mass	relative charge	location in atom
proton			
neutron			
electron		–1	shells

[3]

(b) Figure 4.1 shows information in the Periodic Table for silicon.

14
Si
silicon
28

Figure 4.1

Determine the electronic configuration for this atom of silicon.

..... [1]

(c) Silicon forms covalent bonds with oxygen.

Describe what is meant by a covalent bond.

.....

..... [1]

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(d) Figure 4.2 shows the structure of compound **J**.

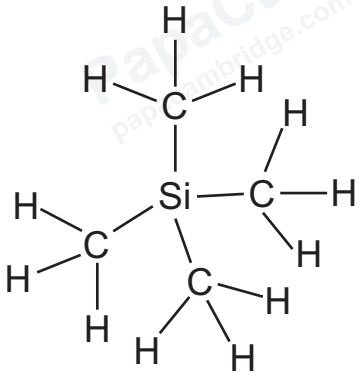


Figure 4.2

Determine the molecular formula for compound **J**.

..... [1]

(e) Some polymers contain silicon.

Define the term polymer.

.....

..... [1]

(f) Copper is a metal.

A mixture of silicon and copper atoms is stronger than pure copper.

Name this type of mixture.

..... [1]

[Total: 8]

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5 **(a)** Excess solid magnesium carbonate reacts with dilute hydrochloric acid.

Aqueous magnesium chloride and two other products are formed.

(i) Complete the word equation for this reaction.

magnesium carbonate	+	hydrochloric acid	→	magnesium chloride	+		+	

[1]

(ii) The reaction is exothermic.

State the meaning of exothermic in terms of energy transfer.

.....

..... [1]

(iii) State the colour of methyl orange indicator in dilute hydrochloric acid.

..... [1]

(iv) Name the method used to remove the excess magnesium carbonate after the reaction has finished.

..... [1]

(b) Aqueous sodium hydroxide is added to aqueous magnesium ions. A white precipitate forms.

Circle the name of **one** other ion which gives a white precipitate when aqueous sodium hydroxide is added.

calcium **copper(II)** **iron(II)** **iron(III)**

[1]

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(c) Molten magnesium chloride is electrolysed using the apparatus shown in Figure 5.1.

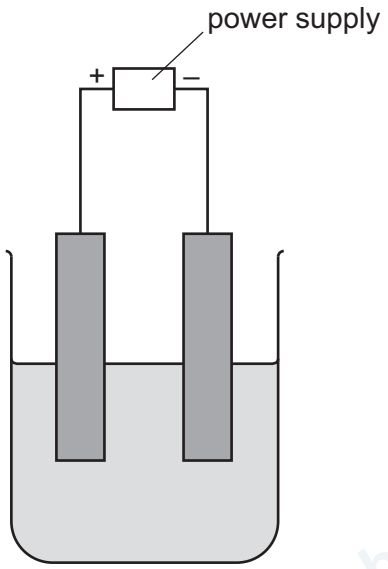


Figure 5.1

(i) On Figure 5.1 label:

- the cathode
- the electrolyte.

[2]

(ii) Suggest **two** properties that make a material suitable for use as an electrode.

1 .....

2 .....

[2]

[Total: 9]

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6 **(a)** The pie chart in Figure 6.1 shows the composition of clean, dry air.

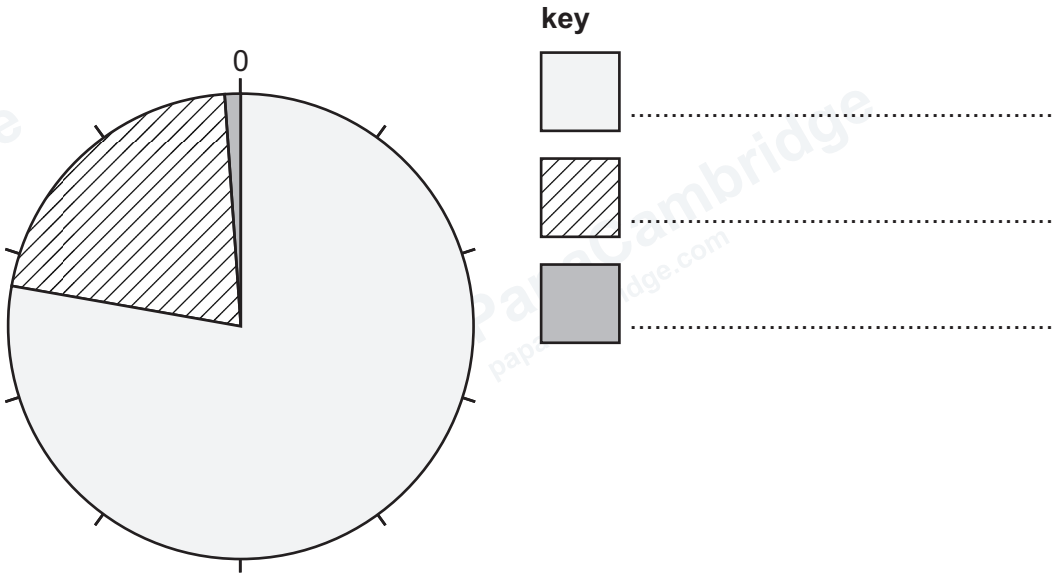


Figure 6.1

Complete the key for the pie chart in Figure 6.1. [2]

(b) Air often contains pollutants.

Draw **one** straight line from each pollutant to its source.

pollutant	source
methane	combustion of fossil fuels which contain sulfur compounds
carbon monoxide	decomposition of vegetation
sulfur dioxide	incomplete combustion of carbon-containing fuels

[2]

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(c) Methane reacts with steam to form carbon monoxide and hydrogen.

(i) Balance the symbol equation for this reaction.

Include state symbols.

$$....CH_4(....) + ...H_2O(....) \rightarrow ....CO(....) + ...H_2(....)$$

[2]

(ii) A nickel catalyst is used in this reaction.

Explain why a catalyst is used.

.....

..... [1]

(d) Nickel is a transition element.

State **two** physical properties of nickel that are different from sodium.

1 .....

2 .....

[2]

[Total: 9]

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7 A student has three different solid spheres, **P**, **Q** and **R**.

(a) (i) Sphere **P** has a mass of 2.6 kg.

Calculate the weight of sphere **P**.

State the unit of your answer.

weight = ... unit ..... [3]

(ii) Complete the statements about mass and weight.

Mass is a measure of the quantity of ..... in an object.

Weight is the ..... force on an object that has mass.

[2]

(b) Sphere **Q** has a mass of 47 g.

(i) Sphere **Q** is placed in a measuring cylinder containing 20 cm^3 of water.

Sphere **Q** sinks to the bottom of the water and the volume increases to 26 cm^3 as shown in Figure 7.1.

before volume = 20 cm^3 **after volume = 26 cm^3**

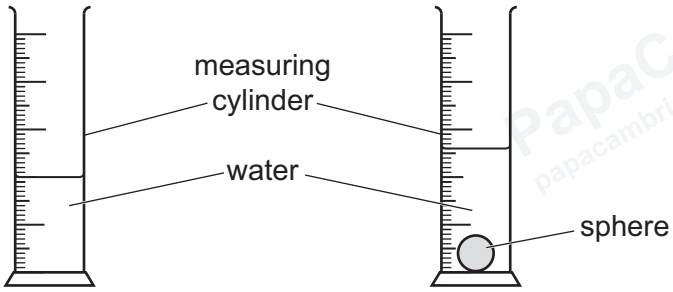


Figure 7.1

Calculate the density of sphere **Q**.

density = ... g / cm^3 [3]

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(ii) Sphere **R** is placed in a different measuring cylinder containing water. Sphere **R** floats at the top of the water.

The density of water is $1.0\,g/cm^3$.

Suggest a value for the density of sphere **R**.

density of sphere **R** = ... g/cm^3 [1]

[Total: 9]

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8 **(a)** Two students, **R** and **S**, do an experiment to determine the speed of sound in air.

Figure 8.1 shows the students standing distance *d* away from a wall.

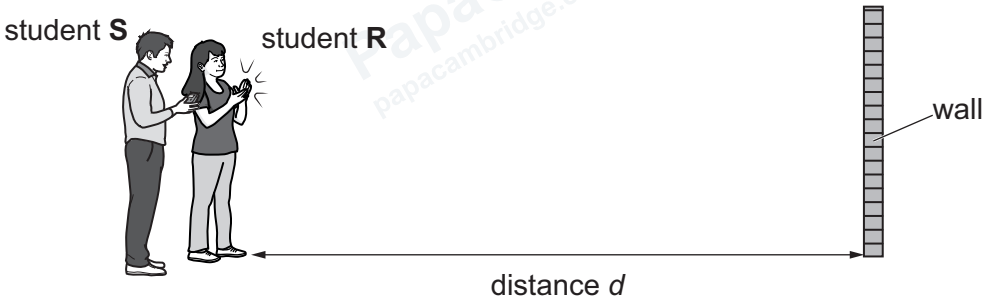


Figure 8.1

Student **R** claps her hands together.

Student **S** starts a stop-watch when he sees student **R** clap her hands together.

Describe how the students determine the speed of sound.

Include:

- the measurements the students take
- the equation used to calculate the speed of sound from the measurements.

.....

.....

.....

.....

..... [3]

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(b) Two sound waves are detected.

- Sound 1 has a higher pitch than sound 2.
- Sound 1 is louder than sound 2.

Tick (✓) **two** boxes which describe the sounds.

Sound 1 and sound 2 are produced by vibrating sources. ☐

The amplitude of sound 1 is greater than the amplitude of sound 2. ☐

The amplitude of each sound is measured in joules (J). ☐

The frequency of each sound is measured in ohms (Ω). ☐

The frequency of sound 1 is less than the frequency of sound 2. ☐

[2]

(c) Figure 8.2 shows a ray of white light passing through a glass prism.

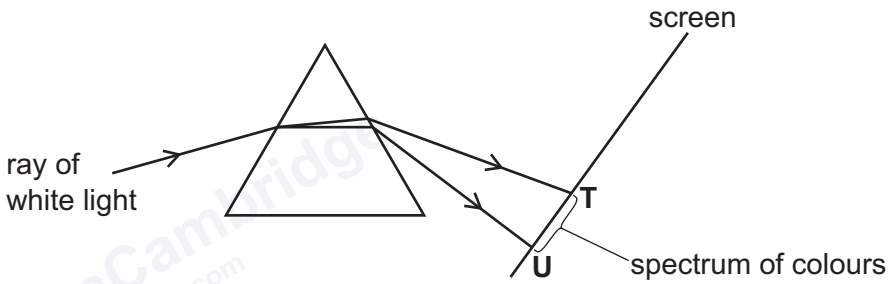


Figure 8.2

Complete the sentences to describe why a spectrum of colours is produced on the screen between points **T** and **U**.

Use words from the list.
Each word may be used once, more than once, or not at all.

inverted **reflected** **refracted**

blue **red** **violet** **white**

The white light is dispersed because it is ..... as it passes from one medium to another.

At point **T**, the colour seen on the screen is ..... .

At point **U**, the colour seen on the screen is ..... .

[3]

[Total: 8]

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9 **(a)** Figure 9.1 shows identical resistors used in three different circuit arrangements.

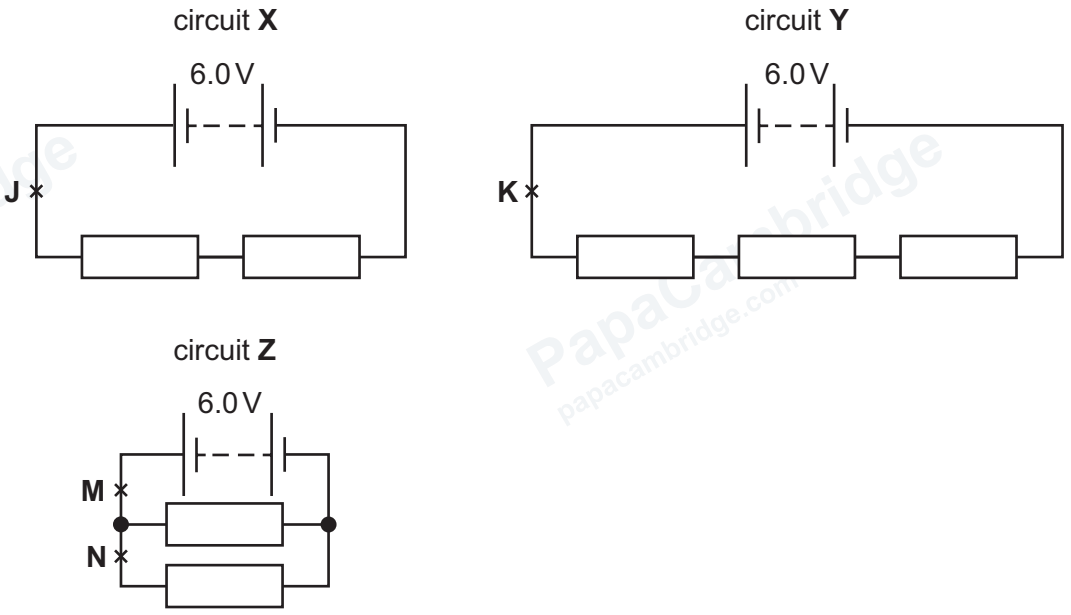


Figure 9.1

Circle **one** phrase in each sentence to compare the current, the voltage and the resistance in the circuits.

The current at point **K** is **less than / the same as / greater than** the current at point **J**.

The current at point **M** is **less than / the same as / greater than** the current at point **N**.

The combined resistance of the resistors in circuit **Z** is **less than / the same as / greater than** the combined resistance of the resistors in circuit **X**.

The voltage across each resistor in circuit **X** is **less than / the same as / greater than** the voltage across each resistor in circuit **Y**.

[4]

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(b) (i) A telescope has an electric motor that enables it to track objects in the Solar System.

The power of the motor is 30 W.
The current in the motor is 2500 mA.

Calculate the voltage across the motor.

voltage = ... V [3]

(ii) Name an example of a star, a planet and a dwarf planet in the Solar System.

star .....

planet .....

dwarf planet .....
[3]

[Total: 10]

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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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).

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