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COMBINED SCIENCE **0653/32**

Paper 3 Theory (Core) **February/March 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 **20** pages.

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

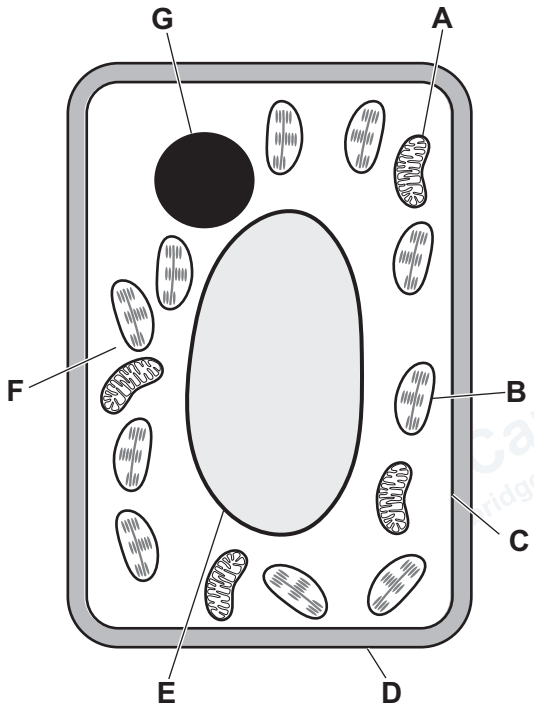


Figure 1.1

(i) State the letter in Figure 1.1 that identifies the part that contains:

the genetic material .....

sap, and supports the cell. .....
[2]

(ii) State the letter in Figure 1.1 that identifies the part present in bacterial cells but **not** present in animal cells.

..... [1]

(iii) Complete the word equation for the chemical reaction that occurs in the part labelled **A** in Figure 1.1.

	+	oxygen	→	carbon dioxide	+	

[2]

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(b) Some bacteria are pathogens.

(i) Describe what is meant by a pathogen.

.....

..... [1]

(ii) State the name of the type of drug that is used to kill bacteria.

..... [1]

(iii) The skin is an example of a body defence against pathogens.

State **two** other body defences against pathogens.

1 .....

2 .....

[2]

[Total: 9]

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2 **(a)** Figure 2.1 is a graph showing the effect of temperature on the activity of enzyme **A** and enzyme **B**.

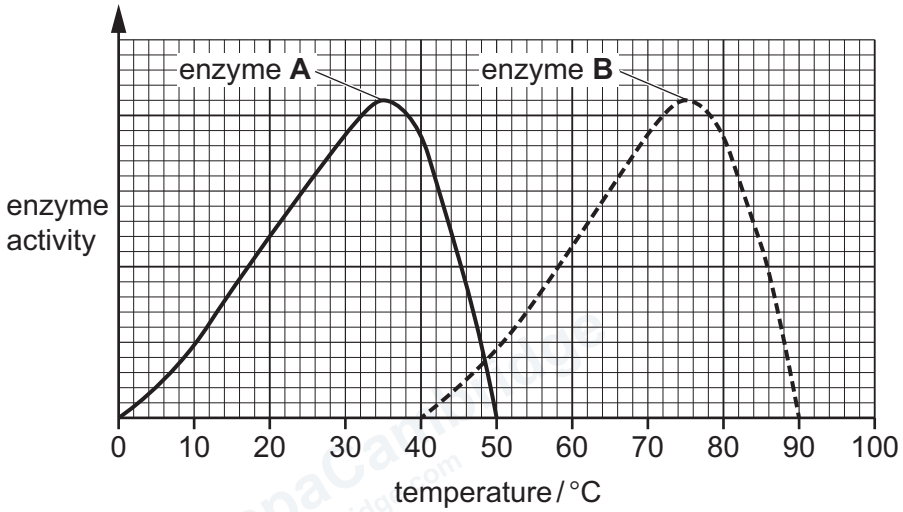


Figure 2.1

(i) Identify the temperature that gives the highest enzyme activity for enzyme **A** in Figure 2.1.

..... °C [1]

(ii) Identify the temperature range where both enzyme **A** and enzyme **B** are active in Figure 2.1.

from ..... °C to ..... °C [1]

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(b) Enzymes are proteins.

Proteins are large molecules required by the body.

(i) Table 2.1 shows some large molecules and the smaller molecules they are made from.

Complete Table 2.1.

One row has been done for you.

Table 2.1

large molecules	smaller molecules
fats and oils	fatty acids and glycerol
protein	
starch	

[2]

(ii) State the **four** chemical elements present in all proteins.

..... [2]

(c) Fats, proteins and carbohydrates are important nutrients in a balanced diet.

(i) Describe the importance of carbohydrates in the diet.

.....

..... [1]

(ii) State the name of **two** other types of nutrient in a balanced diet.

1 .....

2 .....

[2]

[Total: 9]

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3 **(a)** Deforestation is an example of habitat destruction that reduces biodiversity.

(i) Complete the sentence to describe biodiversity.

Biodiversity is the ..... of different

..... that live in an area.

[2]

(ii) Describe **one** reason why habitats are destroyed.

.....

..... [1]

(iii) State **two** other undesirable effects of deforestation.

1 .....

2 .....

[2]

(b) Figure 3.1 is a food chain from a desert ecosystem.

cactus → rat → snake → hawk

Figure 3.1

Table 3.1 shows some terms that are used to describe the organisms in the food chain in Figure 3.1.

Complete Table 3.1 by placing ticks (✓) in the boxes to show all the terms used to describe each organism in the food chain in Figure 3.1.

One row has been done for you.

Table 3.1

organism	producer	herbivore	secondary consumer	carnivore
cactus				
rat				
snake				
hawk				✓

[4]

[Total: 9]

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4 **(a)** In an experiment, a student adds excess dilute hydrochloric acid, HC*l*, to solid copper carbonate, $CuCO_3$.

The apparatus used is shown in Figure 4.1.

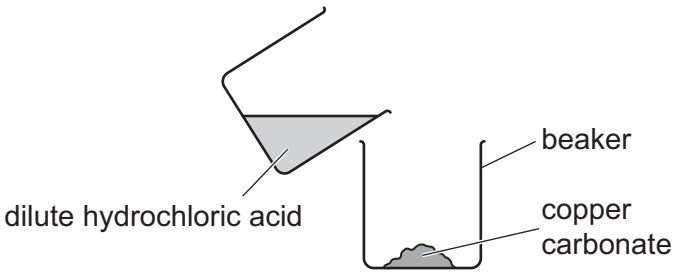


Figure 4.1

(i) State **one** observation the student makes to show that a chemical reaction occurs in this experiment.

..... [1]

(ii) Give the word equation for this reaction.

[ ] + [ ] → [ ] + [ ] + [ ]

[2]

(iii) State **two** ways to decrease the rate of this reaction.

1 .....

2 .....

[2]

(iv) Dilute hydrochloric acid is tested with universal indicator.

Complete the sentences.

In a neutral solution, the colour of universal indicator is ..... .

In dilute acid, the colour of universal indicator turns ..... .

[2]

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(b) Hydrogen chloride, HC*l*, is a gas that dissolves in water to form dilute hydrochloric acid.

Complete the dot-and-cross diagram in Figure 4.2 to show the bonding in a molecule of hydrogen chloride.

Show **only** the outer-shell electrons.

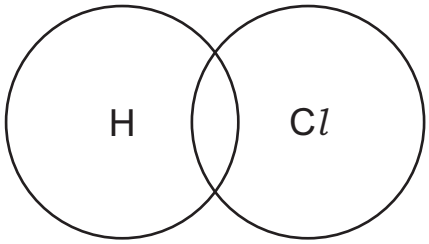


Figure 4.2

[2]

[Total: 9]

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5 **(a)** Figure 5.1 shows part of Group I of the Periodic Table.

3 Li lithium 7
11 Na sodium 23
19 K potassium 39

Figure 5.1

(i) Use Figure 5.1 to determine:

the electronic configuration of an atom of sodium

.....

the number of neutrons in an atom of potassium.

..... [2]

(ii) Explain why an atom of lithium has a neutral charge.

.....

.....

..... [2]

(b) There are trends in the properties of the elements down Group I.

Describe **two** of these trends.

1 .....

2 ..... [2]

(c) Transition elements are metals.

State **one** general property of transition elements that is different to the general properties of Group I.

..... [1]

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(d) Brass and stainless steel are alloys.

Complete the sentences about these alloys.

Brass is a mixture of copper and ..... .

The main metal in stainless steel is ..... mixed with other elements such as chromium, nickel and carbon.

[2]

[Total: 9]

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6 **(a)** Ethane is an alkane.

Figure 6.1 shows the structure of ethane.

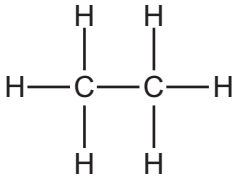


Figure 6.1

(i) Deduce the molecular formula for ethane.

..... [1]

(ii) The boiling point of ethane is –89 °C.

Circle the state symbol for ethane at 20 °C.

(aq) **(g)** **(l)** **(s)**

[1]

(iii) Tick (✓) **all** the statements in Table 6.1 that are true for ethane.

Table 6.1

statement	true
It is the main constituent of natural gas.	
It contains covalent bonds.	
It is saturated.	
It reacts with aqueous bromine.	

[2]

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(b) Methane is another alkane.
During combustion, methane burns in excess oxygen to form carbon dioxide and water.

Balance the symbol equation for this reaction.

$$CH_4 + \ldots\ldots O_2 \rightarrow \ldots\ldots CO_2 + \ldots\ldots H_2O$$

[1]

(c) Methane burns in a limited supply of oxygen to form carbon monoxide and particulates.

(i) Name this type of combustion.

..... [1]

(ii) Describe **one** adverse effect of carbon monoxide and **one** adverse effect of particulates.

carbon monoxide .....

particulates .....

[2]

[Total: 8]

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7 **(a)** Figure 7.1 shows the distance–time graph for a car on a journey.

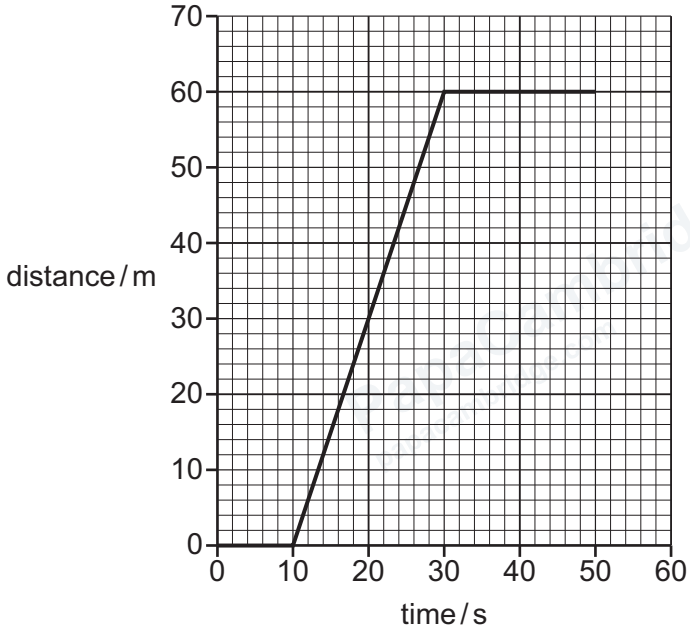


Figure 7.1

(i) Calculate the speed of the car between 10 s and 30 s in Figure 7.1.

speed = ... m / s [2]

(ii) Describe the motion of the car between 30 s and 50 s in Figure 7.1.

..... [1]

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(b) Figure 7.2 shows all the horizontal forces acting on the car while it is moving forwards on a different journey.

force **Y** force **X**

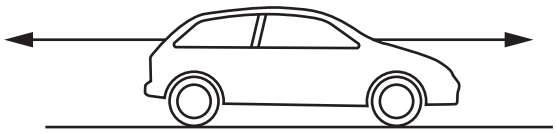


Figure 7.2

Force **X** is 6000 N. Force **Y** is 6000 N.

(i) Describe the motion of the car in Figure 7.2.

..... [1]

(ii) State the name of force **Y** in Figure 7.2.

..... [1]

(c) **(i)** The weight of the car is 7800 N.

The total area of the car tyres in contact with the ground is 650 cm^2.

Calculate the pressure exerted by the car on the ground.

pressure = ... N/cm^2 [2]

(ii) The car is parked in direct sunlight on a hot day.

The temperature of the car tyres increases.

Describe the effect this increase in temperature has on the motion of the air particles inside the tyres.

.....

..... [1]

[Total: 8]

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8 **(a)** Figure 8.1 shows a wave.

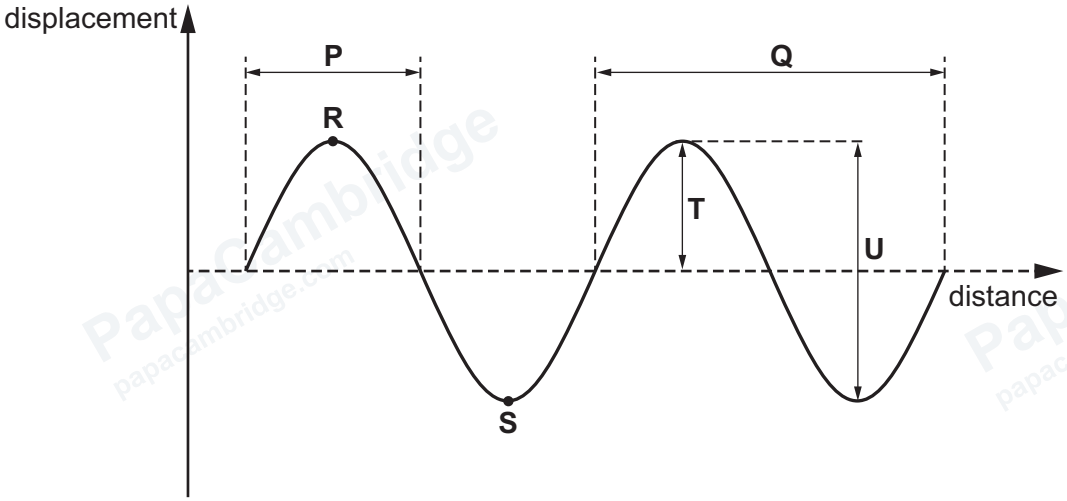


Figure 8.1

(i) State the letter in Figure 8.1 that labels:

a crest (peak) .....

the wavelength .....

the amplitude. .....

[3]

(ii) A radio station broadcasts radio waves of wavelength 750 m.

The radio waves travel at a speed of 3.0×10^8 m/s.

Calculate the frequency of the radio waves.

State the unit.

frequency = ... unit ..... [3]

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(b) Figure 8.2 shows an electric kettle a student uses to boil water.



Figure 8.2

(i) The kettle has a power of 2.0 kW. The student uses the kettle for 6.0 hours during a week.

Electricity costs $0.25 per kW h.

Calculate the cost of using the kettle.

cost = $ ..... [2]

(ii) The water in the kettle is heated by a metal heating element at the bottom of the kettle.

Use the words to complete the descriptions of the thermal energy transfers in the kettle.

Use each word only once.

conduction **convection** **radiation**

Thermal energy is transferred through the heating element mainly

by ..... .

Thermal energy is transferred through the water mainly

by ..... .

Thermal energy is transferred from the outer surface of the kettle to the student

standing to the side of the kettle by ..... .

[2]

[Total: 10]

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9 **(a)** A student uses the circuit in Figure 9.1 to determine the resistance of resistor **K**.

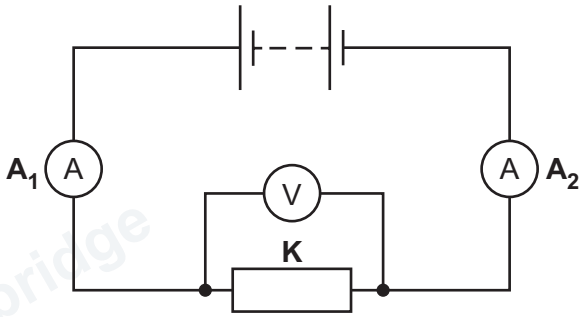


Figure 9.1

The reading on the voltmeter is 9.0 V.

The reading on ammeter $\mathbf{A_1}$ is 1.5 A.

(i) Complete the sentence.

Current is related to the flow of ..... . [1]

(ii) State the reading on ammeter $\mathbf{A_2}$ in Figure 9.1.

Give a reason for your answer.

reading = ... A

reason .....

..... [1]

(iii) Calculate the resistance of resistor **K** in Figure 9.1.

resistance = ... Ω [2]

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(b) The Sun is mostly made of two gases.

Circle these **two** gases.

chlorine **helium** **hydrogen** **nitrogen** **oxygen**

[1]

(c) An object has a weight of 72 N on the Moon.

The gravitational field strength of the Moon is 1.6 N / kg.

Calculate the weight of the object on Earth.

weight = ... N [4]

[Total: 9]

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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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