



Cambridge IGCSE™

COMBINED SCIENCE

Paper 2 Multiple Choice (Extended)

0653/21

May/June 2025

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- 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 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.

- 1 Osmosis can be defined as the net movement of1..... molecules from a region of2..... water potential to a region of3..... water potential, through a partially permeable membrane.

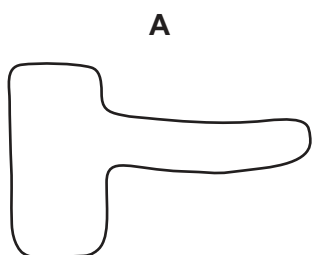
Which words complete gaps 1, 2 and 3?

	1	2	3
A	sugar	higher	lower
B	sugar	lower	higher
C	water	lower	higher
D	water	higher	lower

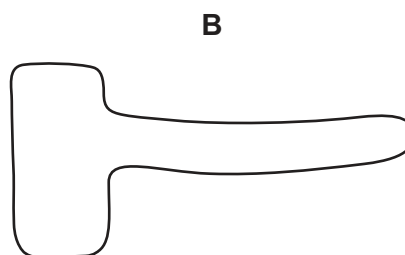
- 2 The diagrams show four root hair cells.

Each cell is surrounded by soil with the same volume of water present.

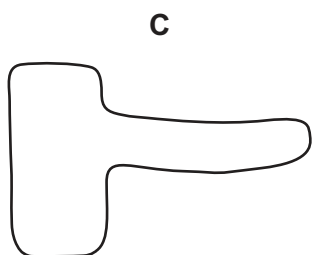
Which root hair cell absorbs water the most rapidly?



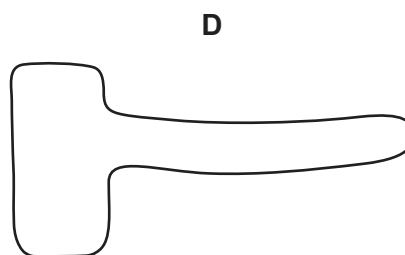
soil temperature 10 °C



soil temperature 10 °C



soil temperature 20 °C



soil temperature 20 °C

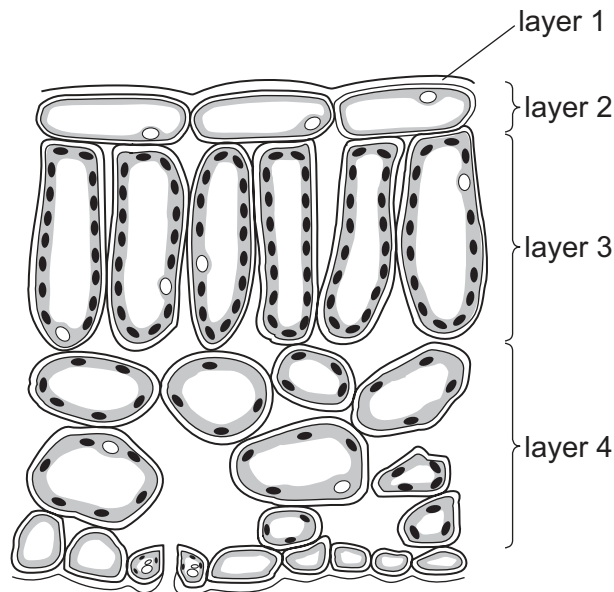
- 3 Which statement explains how an increase in pH affects enzyme activity?

- A** The active site changes shape.
- B** The substrate is denatured.
- C** There is an increase in the kinetic energy.
- D** The number of collisions increases.

4 What is the balanced equation for photosynthesis?

- A $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
- B $\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow 6\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
- C $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- D $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow 6\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

5 The diagram shows a transverse section through a leaf.

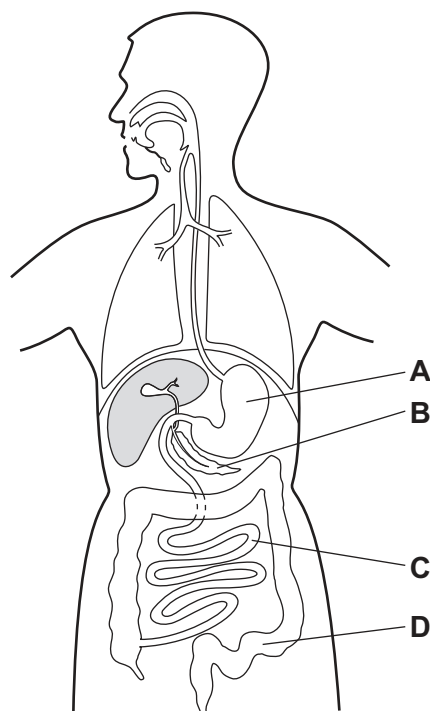


Which layers have cells that can produce oxygen in the presence of light?

- A 1, 2, 3 and 4
 - B 1, 2 and 3 only
 - C 2 and 3 only
 - D 3 and 4 only
- 6 What is the purpose of physical digestion?
- A break down food into smaller pieces
 - B break down insoluble food into soluble molecules
 - C change food so that it can be absorbed into the blood
 - D digest insoluble food molecules using enzymes

- 7 The diagram shows the human alimentary canal and other organs.

Which label shows where glycerol is absorbed?



- 8 Which row describes aerobic respiration?

	nutrient molecules broken down	produces water	releases energy
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = true

✗ = false

- 9 Which row about the anther and stigma of a wind-pollinated flower is correct?

	anther position	stigma position	stigma description
A	inside flower	inside flower	smooth
B	outside flower	outside flower	feathery
C	outside flower	inside flower	smooth
D	inside flower	outside flower	feathery

- 10 Which row shows the effect of deforestation on oxygen and carbon dioxide concentrations in the atmosphere?

	oxygen concentration	carbon dioxide concentration
A	decreases	increases
B	decreases	no change
C	increases	decreases
D	no change	increases

- 11 Which term describes an area that contains all the organisms and their environment interacting together?

- A** community
B ecosystem
C food chain
D food web

- 12 Which row shows how active immunity is gained?

	from antibodies supplied in an injection	by vaccination	after an infection by a pathogen
A	✓	✗	✗
B	✗	✓	✗
C	✗	✓	✓
D	✓	✗	✓

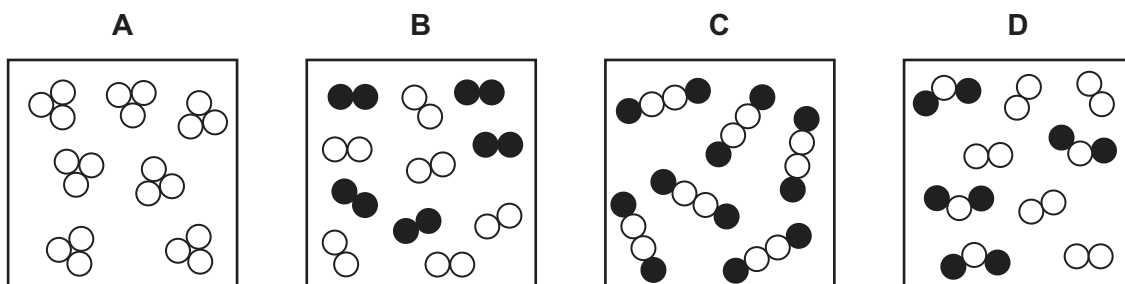
key
 ✓ = yes
 ✗ = no

- 13 Which statements about antibiotics are correct?

- 1 An antibiotic is a drug.
- 2 Antibiotics kill bacteria and viruses.
- 3 MRSA is a type of bacteria resistant to antibiotics.

- A** 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

14 Which diagram represents a mixture of elements?



15 A neutral atom of chlorine contains 17 electrons and 18 neutrons.

What is the atomic number and what is the mass number of this atom?

	atomic number	mass number
A	17	35
B	17	52
C	18	35
D	18	52

16 The elements in Period 2 and Period 3 of the Periodic Table are shown.

Period 2	Li	Be	B	C	N	O	F	Ne
Period 3	Na	Mg	Al	Si	P	S	Cl	Ar

Which statement about atoms of these elements is correct?

- A** Beryllium and boron have the same number of outer-shell electrons.
- B** Boron and aluminium both have three electron shells.
- C** Oxygen and sulfur have the same number of neutrons.
- D** Phosphorus has eight more protons than nitrogen.

17 Which statement describes the formation of ions?

- A** Metal atoms gain electrons to form cations and non-metal atoms lose electrons to form anions.
- B** Metal atoms gain electrons to form anions and non-metal atoms lose electrons to form cations.
- C** Metal atoms lose electrons to form cations and non-metal atoms gain electrons to form anions.
- D** Metal atoms lose electrons to form anions and non-metal atoms gain electrons to form cations.

- 18 The formula of sodium phosphate is Na_3PO_4 . The formula of calcium nitrate is $\text{Ca}(\text{NO}_3)_2$.

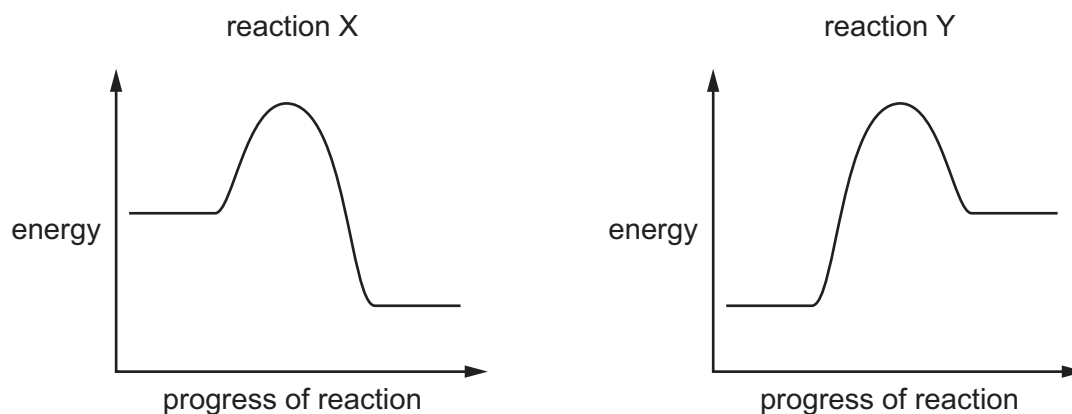
Which row shows the formula for calcium phosphate and the formula for sodium nitrate?

	calcium phosphate	sodium nitrate
A	$\text{Ca}_2(\text{PO}_4)_3$	NaNO_3
B	$\text{Ca}_2(\text{PO}_4)_3$	$\text{Na}(\text{NO}_3)_2$
C	$\text{Ca}_3(\text{PO}_4)_2$	NaNO_3
D	$\text{Ca}_3(\text{PO}_4)_2$	$\text{Na}(\text{NO}_3)_2$

- 19 Which row shows what forms at the electrodes during electrolysis of an aqueous compound?

	anode	cathode
A	metal	non-metal
B	non-metal	metal
C	hydrogen	metal
D	hydrogen	oxygen

- 20 The reaction pathway diagrams for reaction X and for reaction Y are shown.



Which statement about the reactions is correct?

- A** Reaction X has a greater activation energy than reaction Y.
- B** Reaction X is endothermic and reaction Y is exothermic.
- C** The overall energy change in reaction X is much greater than in reaction Y.
- D** The temperature increases during reaction X and decreases during reaction Y.

21 Which statement about catalysts is correct?

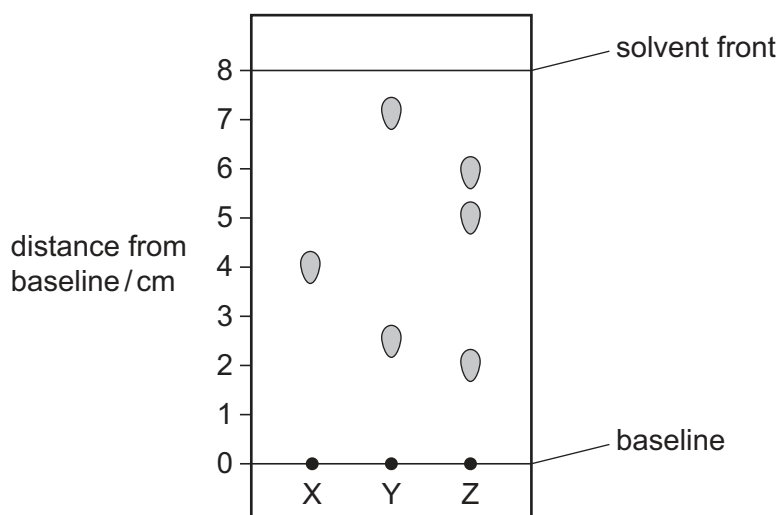
- A Catalysts decrease the rate of reaction.
- B Catalysts increase the concentration of reactants.
- C Catalysts are unchanged at the end of a reaction.
- D The mass of catalyst decreases during a reaction.

22 Which processes involve a chemical change?

- 1 cracking of an alkane
- 2 polymerisation of ethene
- 3 corrosion of iron

- A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

23 A chromatogram of dyes X, Y and Z is shown.



Which statement about the chromatogram is correct?

- A Dye Y has the spot with the lowest R_f value.
- B Every dye is a mixture of colours.
- C The dyes X, Y and Z do **not** contain the same colour.
- D The spot in dye X has an R_f value of 4.

24 An excess of an insoluble metal carbonate is mixed with an acid.

A salt is produced.

Which row shows steps to obtain a pure salt from the reaction mixture?

	step 1	step 2
A	distil the mixture	collect and dry the solid left behind
B	distil the mixture	condense the gas and collect the liquid formed
C	filter the mixture	collect and dry the solid from the filter paper
D	filter the mixture	crystallise the liquid obtained from the filtration

25 Which type of reaction occurs when alkenes react with bromine?

- A** addition
- B** combustion
- C** displacement
- D** polymerisation

26 Which substances are initially placed in the blast furnace during the production of iron?

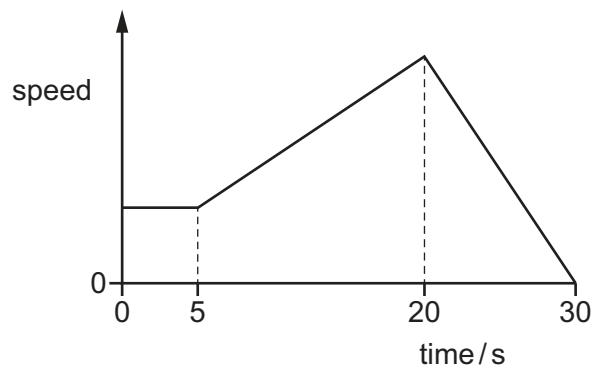
- 1 carbon
- 2 carbon monoxide
- 3 hematite

- A** 1 and 3 **B** 1 only **C** 2 and 3 **D** 3 only

27 Which row correctly explains a strategy to reduce the effects of climate change?

	strategy	explanation
A	plant more trees	trees use up land for growing crops
B	reduce livestock farming	livestock produce methane
C	decrease the use of fossil fuels	combustion of fossil fuels produces nitrogen
D	increase the use of solar power	solar power uses up energy from the Sun

- 28 The graph shows how the speed of a car changes with time. The car travels at constant speed, then accelerates and finally brakes to a stop.



The car travels 60 m while it brakes to a stop.

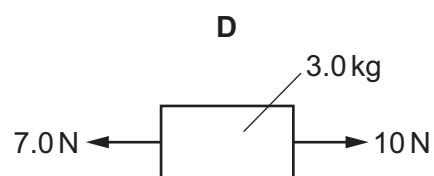
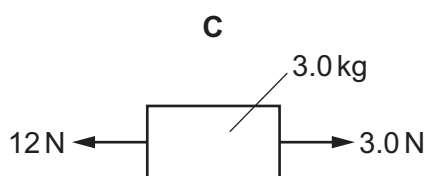
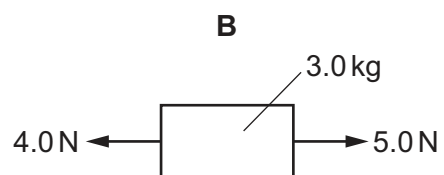
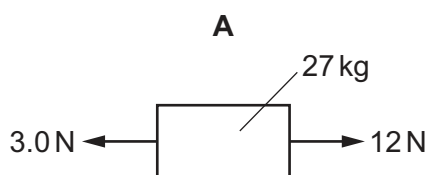
What is the average speed of the car while it brakes?

- A** 3.0 m/s **B** 4.0 m/s **C** 6.0 m/s **D** 12 m/s

- 29 The diagrams show all the forces acting on different objects.

The masses of the objects are shown.

Which object has an acceleration of 3.0 m/s^2 ?



- 30 Which row shows what the weight of an object depends on?

	mass	gravitational field strength
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = depends on this

✗ = does **not** depend on this

- 31 The temperature of a gas increases.

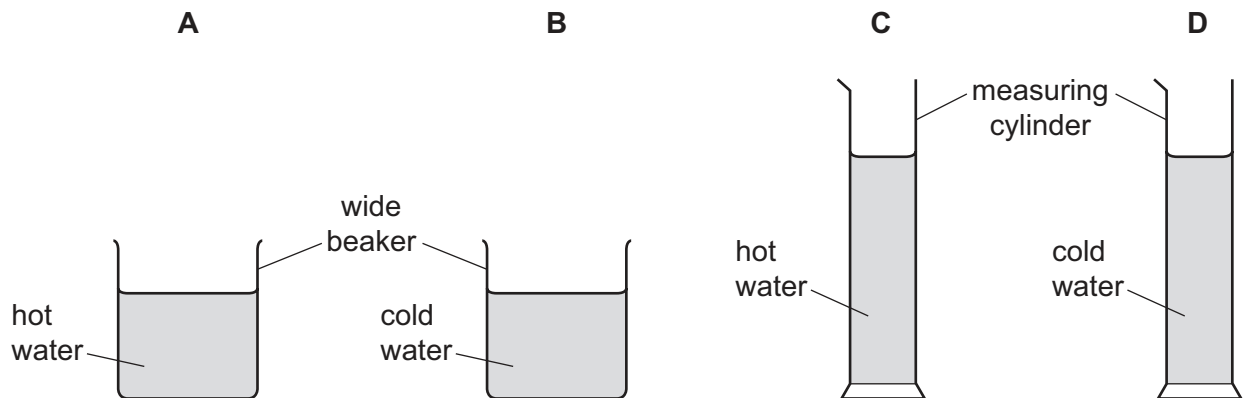
Which row is correct for the particles of the gas?

	force between particles	average speed of particles
A	strong	decreases
B	strong	increases
C	very weak	decreases
D	very weak	increases

- 32 The diagrams show two identical wide beakers and two identical narrow measuring cylinders.

One of the beakers and one of the measuring cylinders contain hot water. The other beaker and measuring cylinder contain cold water.

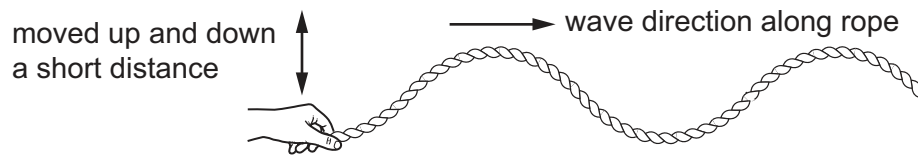
From which container does water evaporate at the greatest rate?



- 33 Which row shows the main method of thermal conduction in metallic and in non-metallic solids?

	metallic solids	non-metallic solids
A	molecular vibrations	molecular vibrations
B	molecular vibrations	movement of electrons
C	movement of electrons	molecular vibrations
D	movement of electrons	movement of electrons

- 34** A student moves one end of a long rope up and down through a short distance. A wave travels along the rope in the direction shown.



The student now moves the rope up and down through a larger distance and more times in each minute.

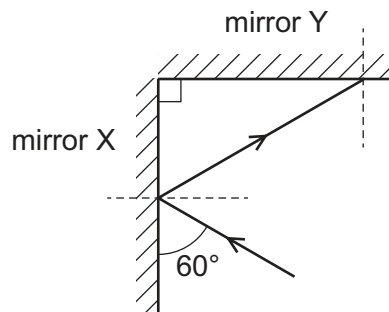
Which row shows the effects of these changes on the amplitude and the frequency of the wave?

	amplitude	frequency
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 35** The diagram shows a ray of light reflected at a plane mirror, X.

The reflected ray strikes another plane mirror, Y.

Mirror Y is at 90° to mirror X.



What is the angle of reflection at mirror Y?

- A** 30° **B** 60° **C** 90° **D** 120°

- 36** Sound travels in solids, liquids and gases. The speed of sound is different in each state.

Which row shows the state with the lowest and highest speed?

	lowest speed	highest speed
A	liquid	solid
B	gas	solid
C	solid	gas
D	solid	liquid

- 37** In which unit is charge measured?

- A** ampere
- B** coulomb
- C** volt
- D** watt

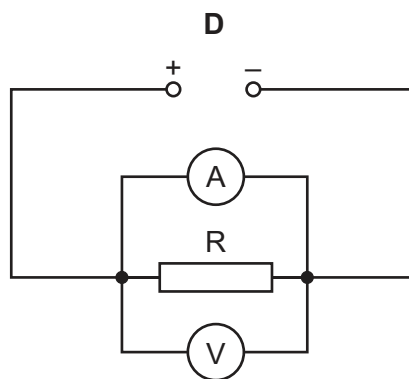
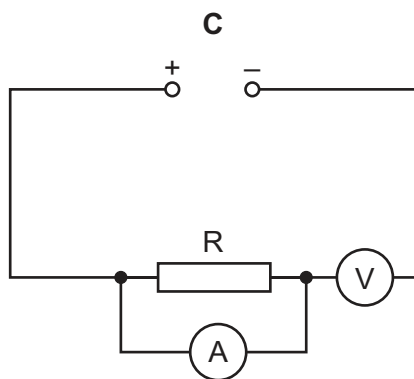
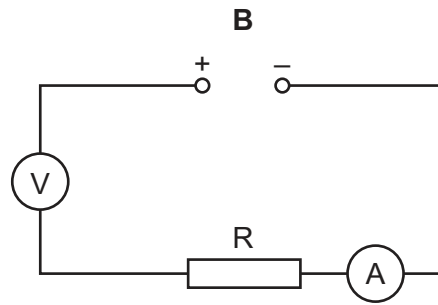
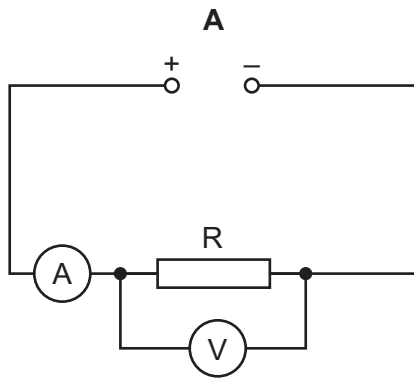
- 38** There is a current of 2.0 A in a resistor of resistance 7.5 Ω .

What is the power and energy transferred in the resistor in 5.0 s?

	power / W	energy / J
A	15	3.0
B	15	75
C	30	6.0
D	30	150

39 A student determines the resistance of resistor R.

Which circuit is used to obtain the readings needed?



40 What is a possible set of stages in the life cycle of stars?

- A** protostar → black hole → red supergiant
- B** protostar → interstellar cloud of gas and dust → new stars
- C** supernova → nebula → new stars
- D** supernova → red supergiant → nebula

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The Periodic Table of Elements

Group																			
I	II											III	IV	V	VI	VII	VIII		
		1 H hydrogen 1																	
		Key atomic number atomic symbol name relative atomic mass																	
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 —		

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
	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 dm³ at room temperature and pressure (r.t.p.).