



Cambridge IGCSE™

PHYSICAL SCIENCE**0652/21**

Paper 2 Multiple Choice (Extended)

October/November 2021**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.

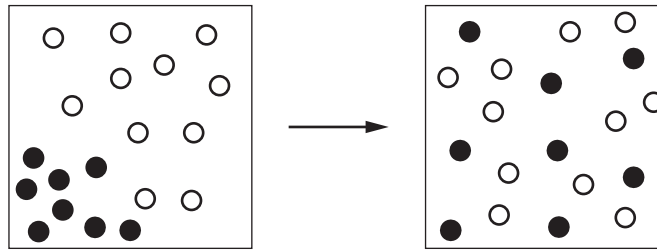
INFORMATION

- 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 **20** pages. Any blank pages are indicated.



- 1 The diagram shows the movement of particles during a physical change.



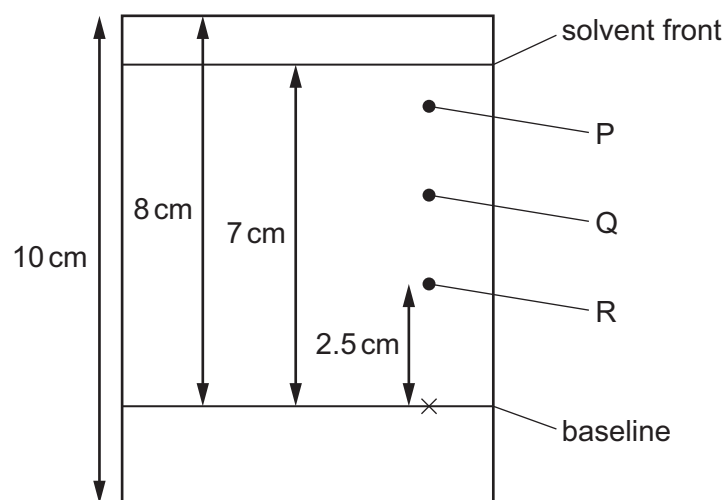
Which process is represented by the diagram?

- A condensation
 - B diffusion
 - C melting
 - D precipitation
- 2 When ammonium chloride is added to water, the mixture becomes cooler.

Which piece of apparatus is used to measure this change?

- A balance
 - B burette
 - C stop-clock
 - D thermometer
- 3 The chromatogram obtained from an ink is shown.

The ink contains three different colours P, Q and R.



What is the R_f value of colour R?

- A 0.25
- B 0.3
- C 0.36
- D 2.5

4 The table shows the electronic structure of four atoms from four different elements.

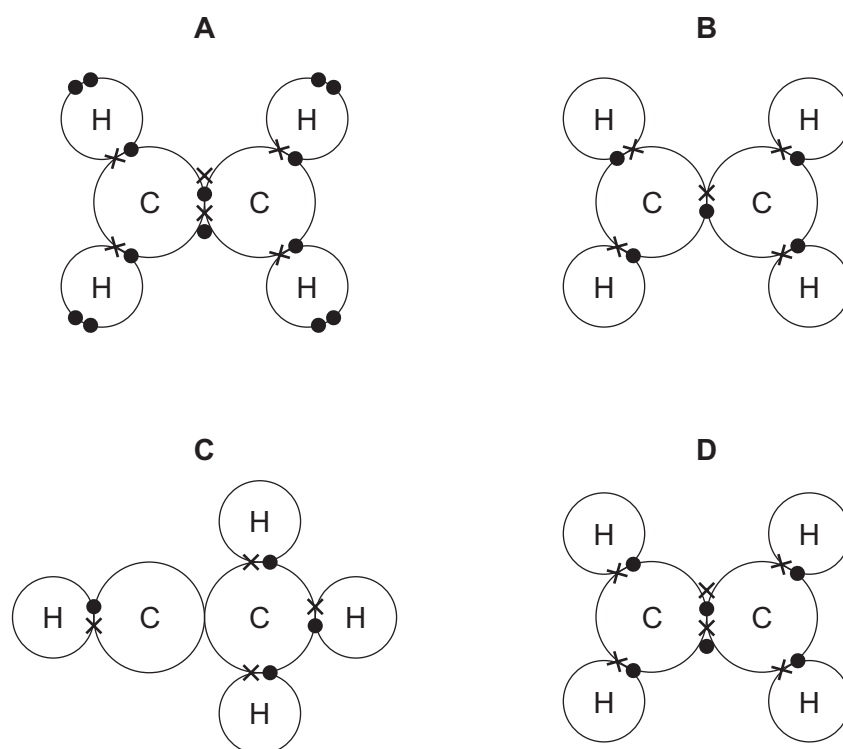
The letters shown are not the symbols of the elements.

| atom | J | K | L | M |
|----------------------|-------|-----|-----|-----|
| electronic structure | 2,8,1 | 2,7 | 2,8 | 2,1 |

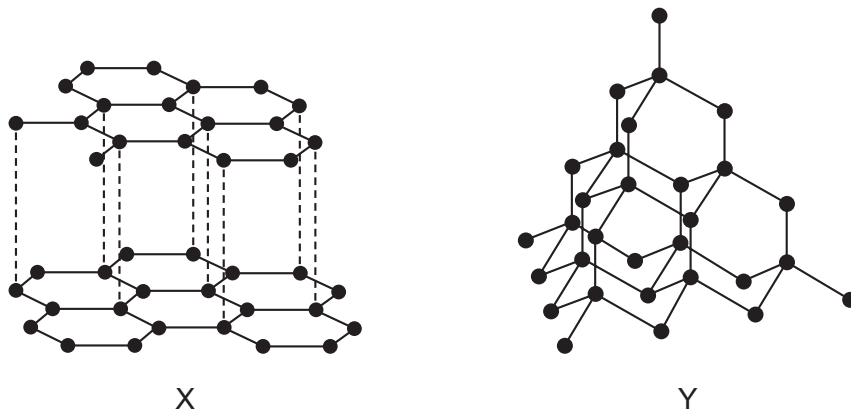
Which atoms combine with chlorine to form an ionic compound?

- A** J and M **B** J only **C** K only **D** L and M

5 What is the outer electron arrangement in a molecule of ethene?



6 Two structures X and Y are shown.

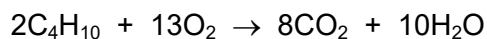


Which row is correct?

| | identity of X | identity of Y | hardness | conductivity |
|----------|---------------|---------------|------------------|------------------|
| A | diamond | graphite | X greater than Y | X less than Y |
| B | diamond | graphite | X less than Y | X greater than Y |
| C | graphite | diamond | X greater than Y | X less than Y |
| D | graphite | diamond | X less than Y | X greater than Y |

7 Butane gas is used as the fuel in camping stoves.

Butane burns in air to produce carbon dioxide and water. The equation is shown.



What are the volumes of oxygen used and carbon dioxide produced by burning 40 cm^3 of butane?

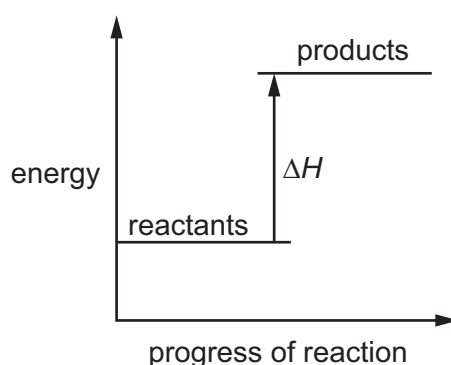
| | oxygen $/\text{cm}^3$ | carbon dioxide $/\text{cm}^3$ |
|----------|--------------------------|----------------------------------|
| A | 40 | 80 |
| B | 40 | 160 |
| C | 260 | 160 |
| D | 260 | 240 |

8 Molten lead(II) bromide is electrolysed using inert electrodes.

Which row identifies the product and the reaction occurring at the cathode?

| | product | reaction at the cathode |
|----------|---------|-----------------------------|
| A | bromine | bromide ions gain electrons |
| B | bromine | bromide ions lose electrons |
| C | lead | lead ions gain electrons |
| D | lead | lead ions lose electrons |

9 An energy level diagram is shown.



Which change does this energy level diagram represent?

- A** $\text{C(g)} + 4\text{H(g)} \rightarrow \text{CH}_4\text{(g)}$
- B** $\text{H}_2\text{(g)} \rightarrow 2\text{H(g)}$
- C** $\text{CH}_4\text{(g)} + 2\text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} + 2\text{H}_2\text{O(g)}$
- D** $\text{H}_2\text{O(g)} \rightarrow \text{H}_2\text{O(l)}$
- 10 Which change decreases the rate of reaction between lumps of zinc and dilute sulfuric acid?
- A** Add a suitable catalyst.
- B** Add water to the acid.
- C** Break the lumps of zinc into smaller pieces.
- D** Use a higher temperature.
- 11 Which type of substance accepts protons?
- A** acid
- B** base
- C** oxidising agent
- D** reducing agent

12 Substances P and Q are oxides.

Substance P reacts with carbon dioxide, but it does not react with sodium oxide.

Substance Q reacts with both carbon dioxide and sodium oxide.

Which row identifies the two types of oxide?

| | P | Q |
|----------|--------|------------|
| A | acidic | amphoteric |
| B | acidic | neutral |
| C | basic | amphoteric |
| D | basic | neutral |

13 A gas is tested as shown.

| test | observation |
|--|-----------------------------|
| lighted splint is placed in the gas | lighted splint goes out |
| damp red litmus paper is placed in the gas | red litmus paper turns blue |
| gas is passed through limewater | limewater is colourless |

What is the gas?

- A** ammonia
- B** carbon dioxide
- C** chlorine
- D** hydrogen

14 Which statement about the Periodic Table is correct?

- A** Elements with the highest number of electrons in their outer shell are the most non-metallic.
- B** Non-metallic elements react by losing their outer shell electrons.
- C** The elements with the largest group number are the best electrical conductors.
- D** The group number is the total number of electron shells.

15 Which row describes the properties of a transition element?

| | melting point /°C | density /g/cm ³ | colour of compounds |
|----------|-------------------|----------------------------|---|
| A | -210 | 0.0011 | one oxide is brown, but most compounds are colourless |
| B | 98 | 0.97 | all the compounds are white |
| C | 328 | 11.34 | the iodide is yellow, but most compounds are white |
| D | 1535 | 7.86 | most compounds are either green or brown |

16 Four different metals W, X, Y and Z are added to solutions of their metal nitrates.

The results are shown.

| metal added | solution of metal nitrate | | | | key |
|-------------|---------------------------|-----------|-----------|-----------|-------------------------------|
| | W nitrate | X nitrate | Y nitrate | Z nitrate | |
| W | | ✓ | x | x | ✓ = reacts x = no reaction |
| X | x | | x | x | |
| Y | ✓ | ✓ | | x | |
| Z | ✓ | ✓ | ✓ | | |

What is the order of reaction?

| | least reactive | | → | most reactive | |
|----------|----------------|---|---|---------------|---|
| A | X | W | | Y | Z |
| B | X | Y | | W | Z |
| C | Z | W | | Y | X |
| D | Z | Y | | W | X |

17 Which equation represents a reaction where pollutant gases are removed by a catalytic converter?

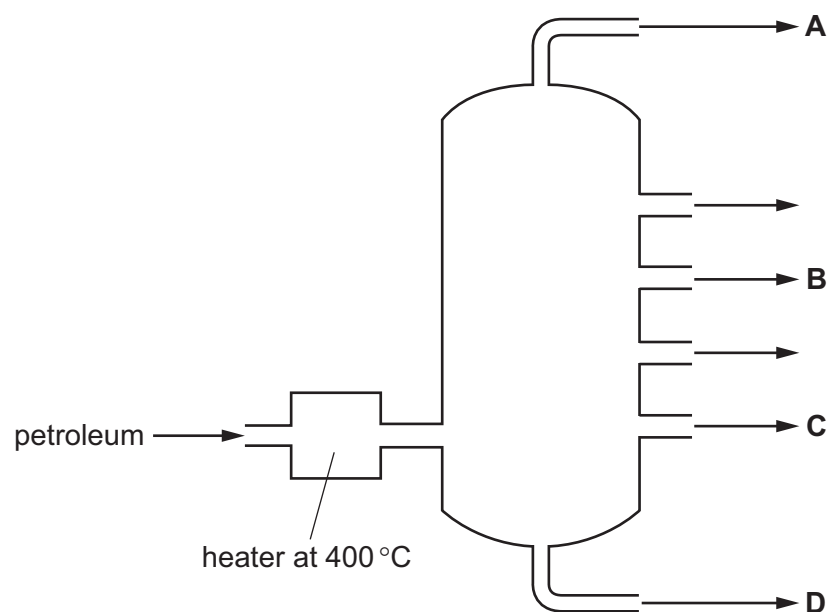
- A** $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$
- B** $2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$
- C** $3\text{CO} + \text{Fe}_2\text{O}_3 \rightarrow 3\text{CO}_2 + 2\text{Fe}$
- D** $2\text{CO}_2 + \text{N}_2 \rightarrow 2\text{CO} + 2\text{NO}$

18 Which process does **not** produce carbon dioxide?

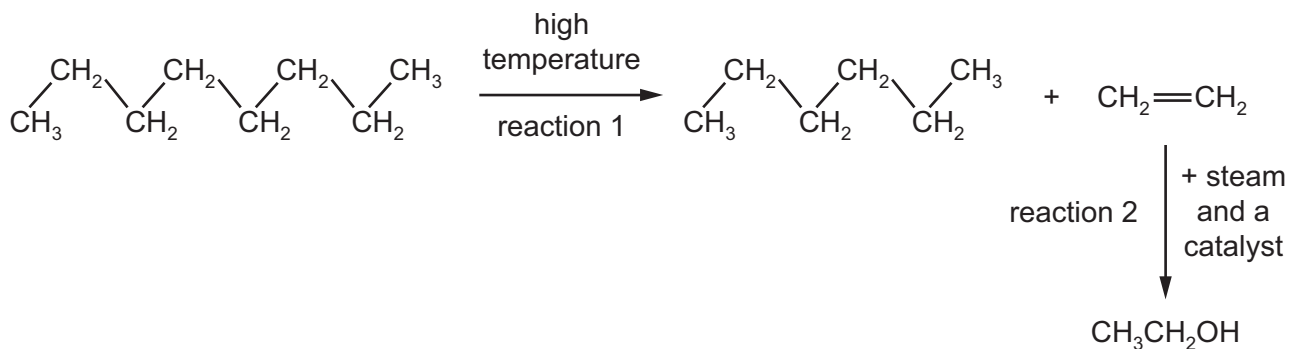
- A an acid reacting with a carbonate
- B burning coal
- C burning hydrogen
- D respiration

19 The fractional distillation of petroleum is shown.

From which position is methane obtained?



20 The diagram shows a two-step reaction scheme.



What are the names given to reaction 1 and reaction 2?

| | reaction 1 | reaction 2 |
|----------|----------------|--------------|
| A | cracking | addition |
| B | cracking | fermentation |
| C | polymerisation | addition |
| D | polymerisation | fermentation |

21 How is the velocity of a moving object related to its speed?

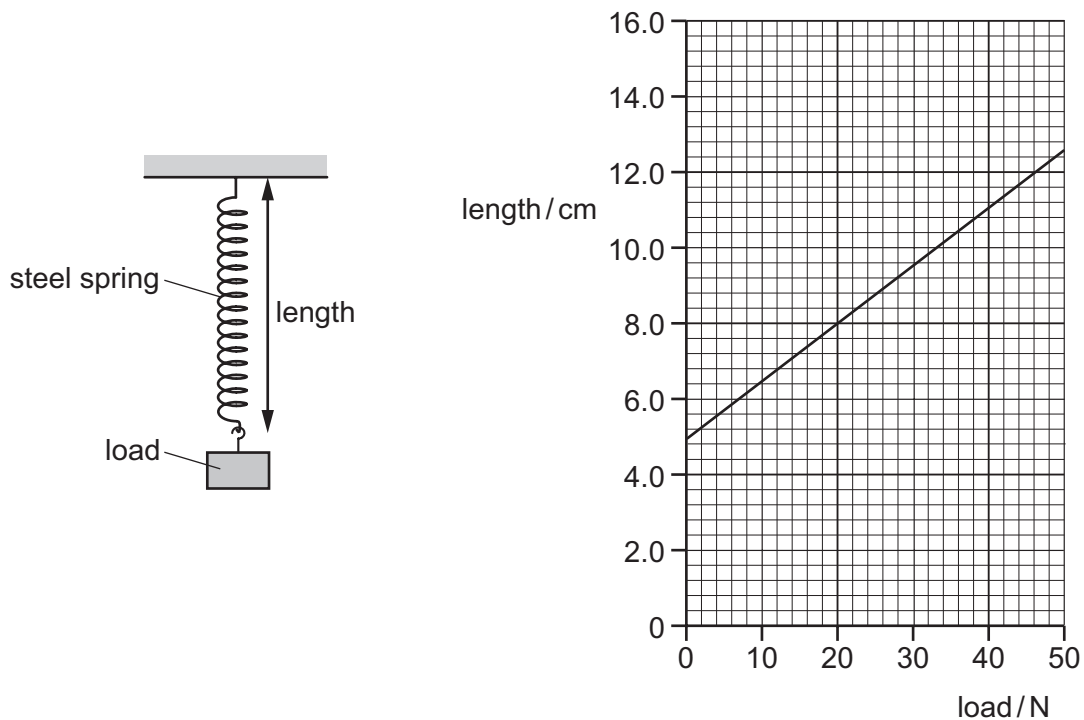
- A** Its speed has the same magnitude as its velocity but its speed also has direction.
- B** Speed is equal to the rate of change of velocity.
- C** Its velocity has the same magnitude as its speed but its velocity also has direction.
- D** Velocity is equal to the rate of change of speed.

22 An object falls vertically at a constant speed in air.

Which statement about the forces on the object is correct?

- A** Air resistance is the only force acting on the object.
- B** The magnitude of the air resistance acting on the object is equal to the weight of the object.
- C** The magnitude of the air resistance acting on the object is greater than the weight of the object.
- D** The magnitude of the air resistance acting on the object is less than the weight of the object.

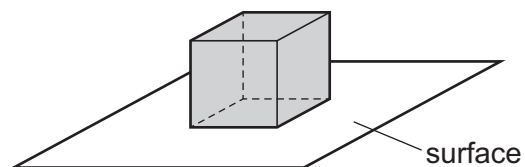
23 The diagrams show a steel spring and a graph of its length against the load applied to it.



What is the extension of the spring when a load of 20 N is applied to it?

- A** 3.0 cm **B** 3.5 cm **C** 5.0 cm **D** 8.0 cm

24 The diagram shows one of four cubes resting on a horizontal surface.



The weight and length of side of each of the four cubes are shown in the table.

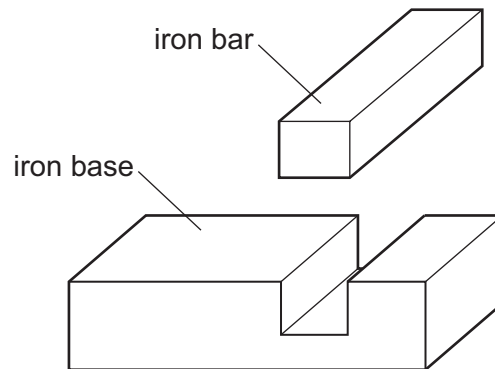
Which cube exerts the greatest pressure on the surface?

| | weight / N | length of side / cm |
|----------|------------|---------------------|
| A | 2.0 | 4.0 |
| B | 4.0 | 2.0 |
| C | 6.0 | 10.0 |
| D | 8.0 | 8.0 |

25 Which energy does an object possess due to its motion?

- A elastic (strain)
- B gravitational potential
- C kinetic
- D thermal

26 An engineer needs to fit an iron bar into a gap in an iron base.

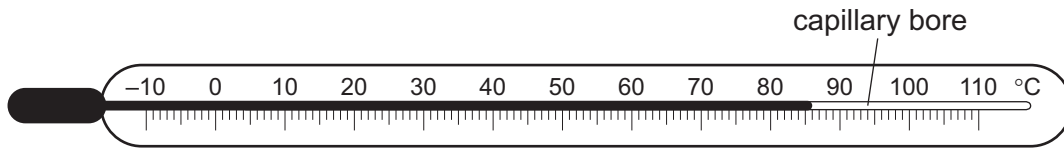


At room temperature, the bar is slightly too big to fit into the gap.

How can the engineer make the bar fit into the gap?

- A Cool the bar and heat the base.
- B Cool the base and cool the bar to the same temperature.
- C Cool the base and heat the bar.
- D Heat the base and heat the bar to the same temperature.

27 The diagram shows a liquid-in-glass thermometer.



A second thermometer has a narrower capillary bore and a different scale, but contains the same volume of liquid and is the same length.

Which row compares the second thermometer with the first thermometer?

| | range of second thermometer | sensitivity of second thermometer |
|----------|-----------------------------|-----------------------------------|
| A | greater | greater |
| B | greater | less |
| C | less | greater |
| D | less | less |

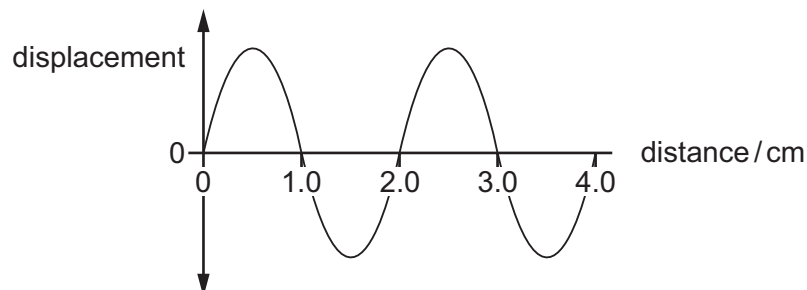
28 Four copper plates of the same size and shape are placed in bright sunshine.

The plates have different surfaces and different colours.

Which plate absorbs radiation from the Sun at the lowest rate?

- A** dull, black surface
- B** dull, white surface
- C** shiny, black surface
- D** shiny, white surface

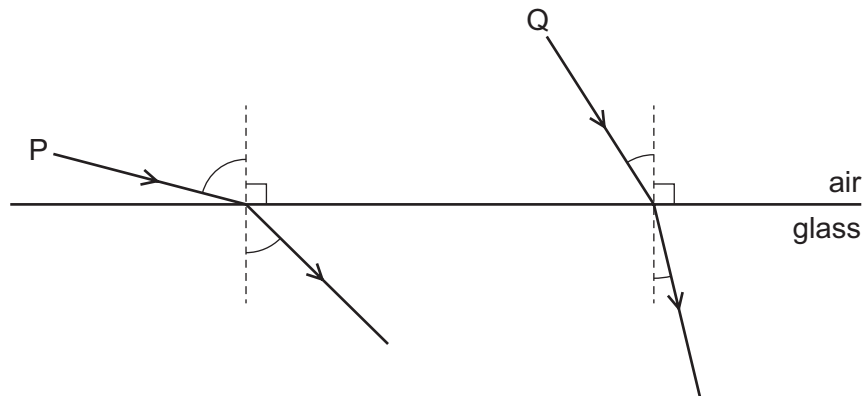
29 The diagram represents a wave. The wave travels at a speed of 20 cm/s.



What is the frequency of the wave?

- A** 5.0 Hz
- B** 10 Hz
- C** 40 Hz
- D** 80 Hz

- 30 The diagram shows two rays of light P and Q passing from air into glass.



The angles of incidence of P and Q are i_P and i_Q .

The angles of refraction of P and Q are r_P and r_Q .

Which row compares the angles of incidence and compares the angles of refraction of rays P and Q?

| | angles of incidence | angles of refraction |
|----------|--------------------------|--------------------------|
| A | i_P bigger than i_Q | r_P bigger than r_Q |
| B | i_P bigger than i_Q | r_P smaller than r_Q |
| C | i_P smaller than i_Q | r_P bigger than r_Q |
| D | i_P smaller than i_Q | r_P smaller than r_Q |

- 31 A converging lens of focal length 15 cm is used as a magnifying glass to produce a virtual, magnified image.

What is a possible position of the object?

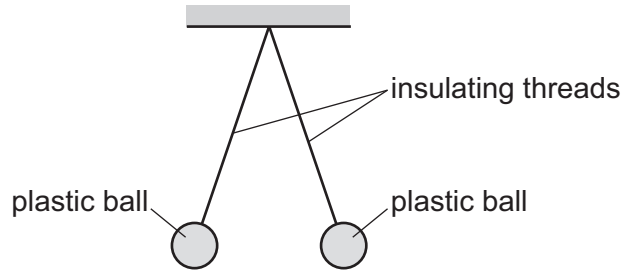
- A** 8.0 cm from the lens
B 16 cm from the lens
C 32 cm from the lens
D 64 cm from the lens
- 32 Which row shows how, in a vacuum, the speed of radio waves and the speed of X-rays compare with the speed of light?

| | speed of radio waves | speed of X-rays |
|----------|----------------------|--------------------|
| A | greater than light | less than light |
| B | the same as light | greater than light |
| C | less than light | greater than light |
| D | the same as light | the same as light |

33 Which frequency is outside the range of audible frequencies for a healthy human ear?

- A 30 Hz B 300 Hz C 3000 Hz D 30 000 Hz

34 The diagram shows two light plastic balls suspended by insulating threads from a support.



Which statement is an explanation of why the plastic balls hang apart from each other?

- A The balls have like charges.
B One ball is charged; the other is uncharged.
C The balls have unlike charges.
D Both balls are uncharged.
- 35 A charger for a mobile phone (cell phone) produces a current of 50 mA for 30 minutes.

How much charge passes through the charger?

- A 1.5 C B 90 C C 1500 C D 90 000 C

36 A copper wire has resistance of 8.0Ω .

The wire is melted and made into a new wire with twice the original length and half the original cross-sectional area.

What is the resistance of the new wire?

- A 4.0Ω B 8.0Ω C 16Ω D 32Ω

37 An electric kettle is connected to a 240 V supply.

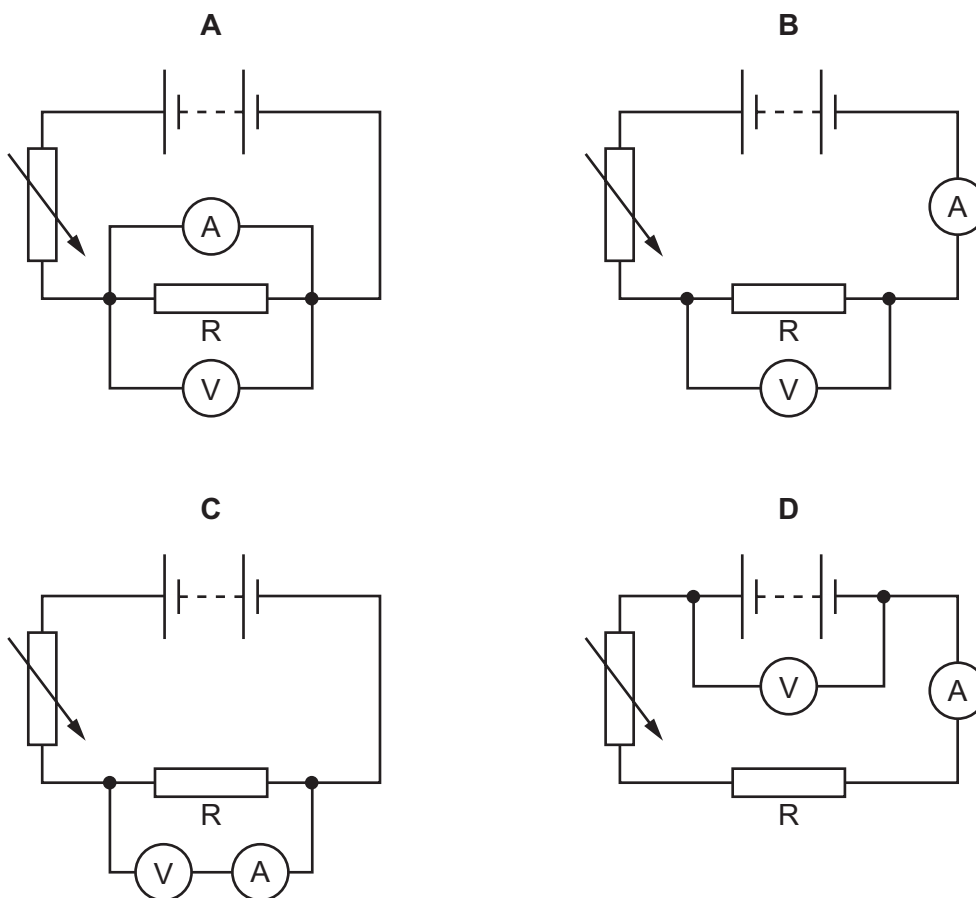
It takes 5.0 minutes to transfer 580 kJ of energy.

What is the current in the kettle?

- A 0.48 A B 2.1 A C 8.1 A D 12 A

38 A student investigates how the current in a resistor R varies with the voltage across it.

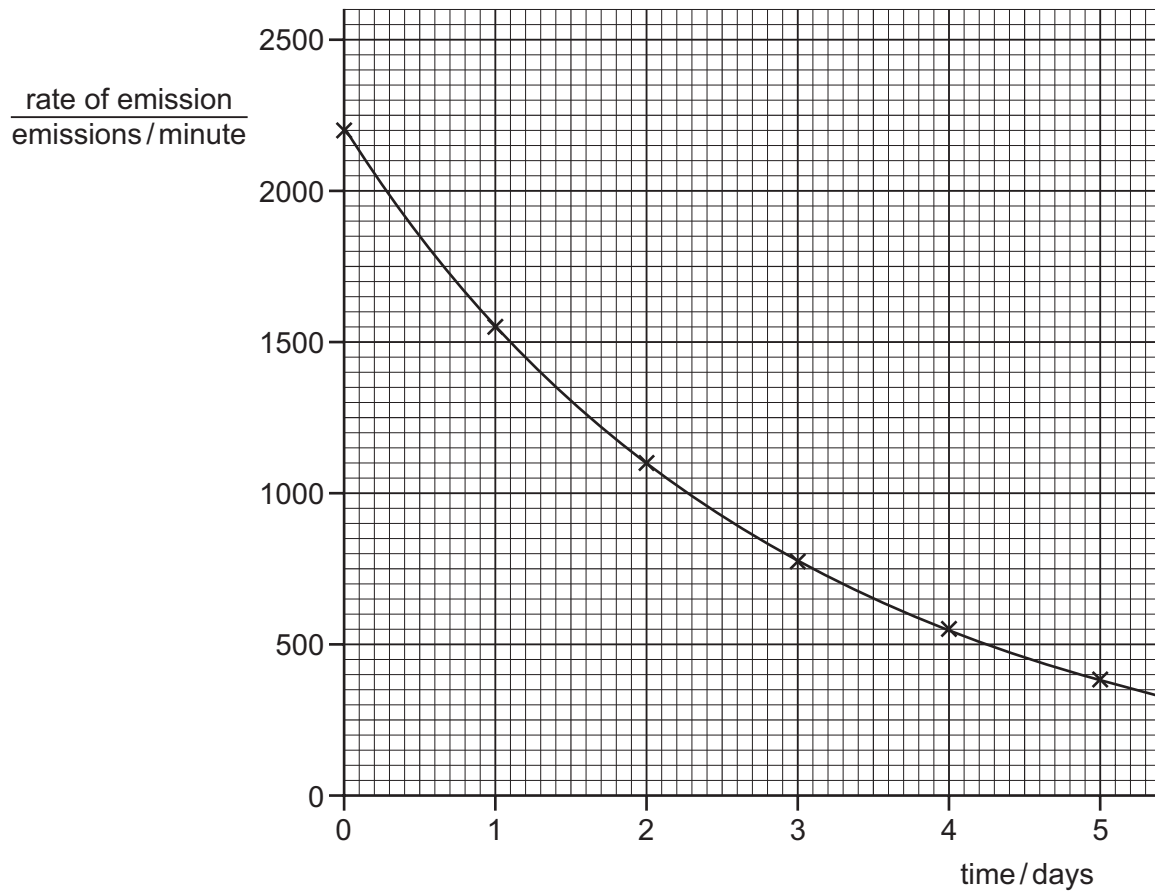
Which circuit does the student use?



39 What is the difference between alternating current (a.c.) and direct current (d.c.)?

- A a.c. changes direction but d.c. does not.
- B a.c. causes a magnetic field but d.c. does not.
- C a.c. transfers energy in a resistor but d.c. does not.
- D a.c. has a constant magnitude but d.c. does not.

40 The graph shows the decay curve for one particular radioactive isotope.



What is the half-life of this isotope?

- A** 1.0 day **B** 1.5 days **C** 2.0 days **D** 2.5 days

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The Periodic Table of Elements

| | | Group | | | | | | | | | | | | | | | |
|-----------------------------------|------------------------------------|--|--|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|------------------------------------|-------------------------------------|----------------------------------|-------------------------------------|
| I | II | | | | | | | | | | | III | IV | V | VI | VII | VIII |
| 3 Li lithium 7 | 4 Be beryllium 9 | Key atomic number atomic symbol name relative atomic mass | | | | | | | | | | 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 | | | | | | | | | | | 1 H hydrogen 1 | 13 Al aluminium 27 | 14 Si silicon 28 | 15 P phosphorus 31 | 16 S sulfur 32 | 17 Cl chlorine 35.5 |
| 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 — | — | — | — | — |

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