



Cambridge IGCSE™

COMBINED SCIENCE

0653/22

Paper 2 Multiple Choice (Extended)

February/March 2022

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 **16** pages.

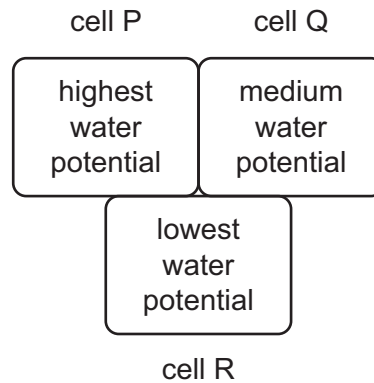


2

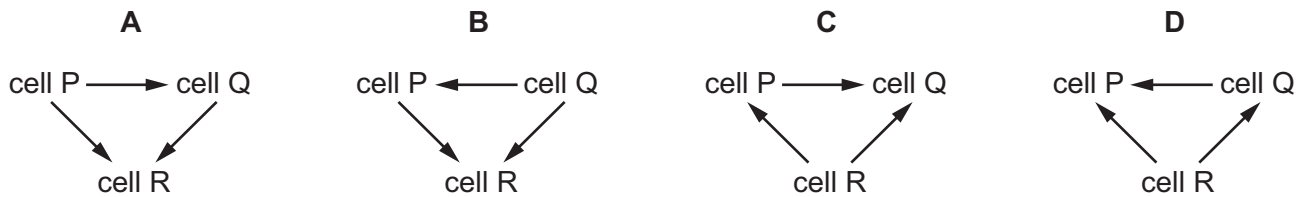
1 What is the function of the cell membrane?

- A to control which substances move in and out of the cell
- B to hold the DNA of the cell
- C to hold the chlorophyll of the cell
- D to store nutrients or waste products

2 The diagram shows three plant cells, P, Q and R.

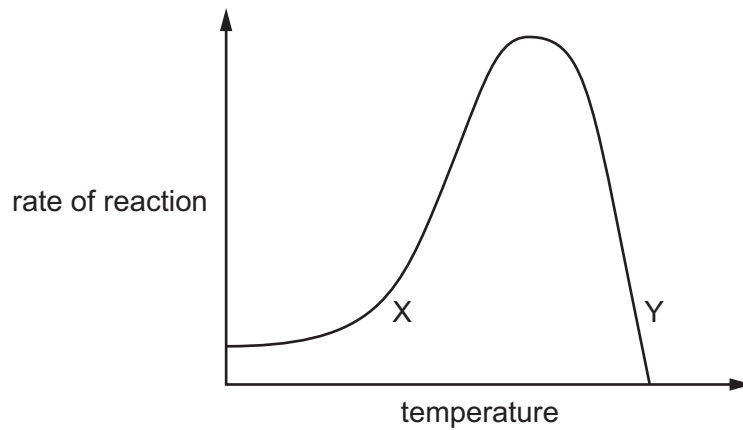


What is the correct net movement of water by osmosis?



3

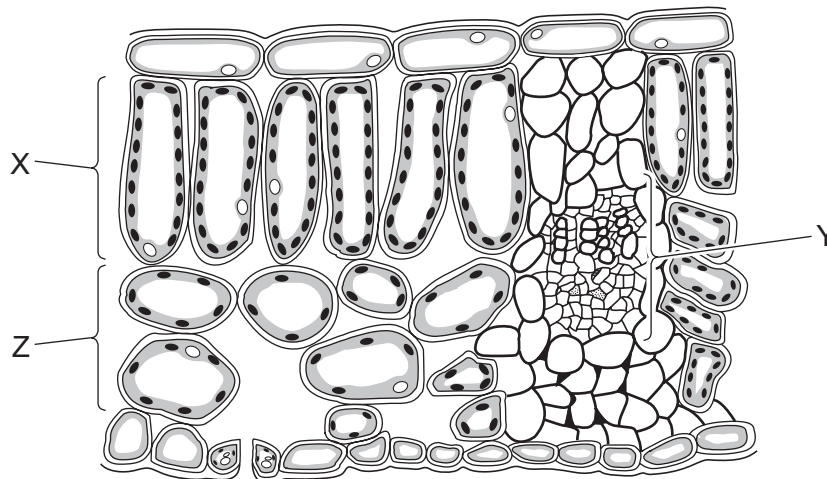
- 3 The graph shows the rate of an enzyme-controlled reaction at different temperatures.



Which row is correct at point X?

| | kinetic energy of substrate | enzyme denatured |
|----------|-----------------------------|------------------|
| A | higher than at Y | no |
| B | higher than at Y | yes |
| C | lower than at Y | no |
| D | lower than at Y | yes |

- 4 The diagram shows a section through a leaf.



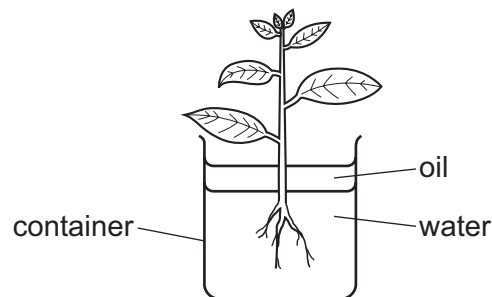
Which row correctly identifies the labelled parts of the leaf section?

| | X | Y | Z |
|----------|--------------------|-----------------|--------------------|
| A | cuticle | vascular bundle | palisade mesophyll |
| B | palisade mesophyll | vascular bundle | spongy mesophyll |
| C | palisade mesophyll | cuticle | spongy mesophyll |
| D | spongy mesophyll | cuticle | vascular bundle |

5 Which row is correct for chemical digestion?

| | food | enzyme | substances produced |
|----------|---------|----------|--------------------------|
| A | fat | protease | fatty acids and glycerol |
| B | fat | lipase | amino acids |
| C | protein | lipase | fatty acids and glycerol |
| D | protein | protease | amino acids |

6 The diagram shows a plant in a container of water. The layer of oil stops the water in the container from evaporating.



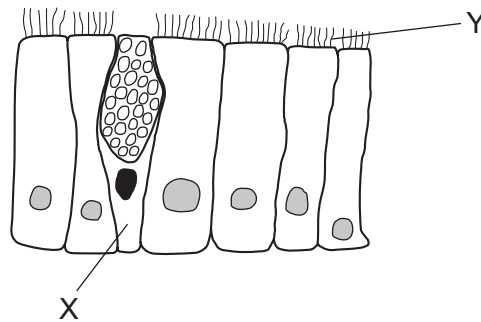
The initial mass of the container and its contents is 296 g.

After two hours, the mass of the container and its contents is 292 g.

What is the rate of transpiration in this time?

- A** 148 g of water per hour
- B** 146 g of water per hour
- C** 4 g of water per hour
- D** 2 g of water per hour

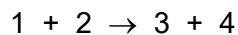
- 7 The diagram shows two different types of cell which line the trachea in the gas exchange system.



Which row describes the roles of X and Y?

| | X | Y |
|----------|-----------------------------------|-----------------------------------|
| A | produces mucus | traps pathogens |
| B | produces mucus | moves pathogens towards the mouth |
| C | moves pathogens towards the mouth | traps pathogens |
| D | moves pathogens towards the mouth | moves pathogens towards the mouth |

- 8 In the equation for respiration shown, the components have been represented by numbers.



Each component has been given a letter, as shown.

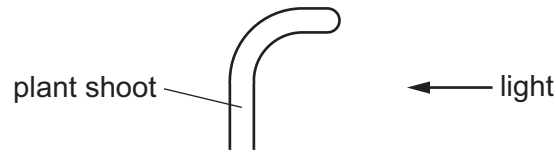
W = carbon dioxide, X = glucose, Y = oxygen, Z = water

Which letter should be inserted into each position in the equation?

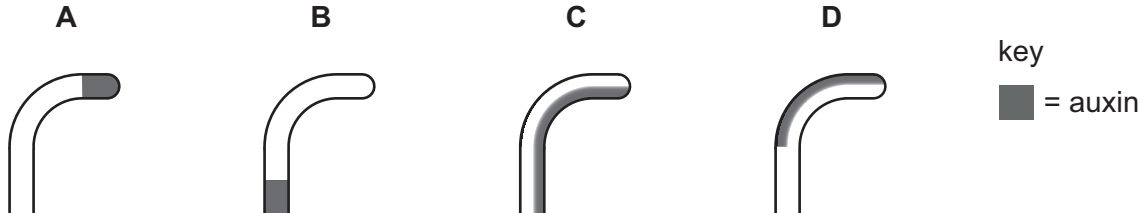
| | 1 | 2 | 3 | 4 |
|----------|---|---|---|---|
| A | W | Y | X | Z |
| B | W | Z | X | Y |
| C | X | Y | W | Z |
| D | X | Z | W | Y |

6

- 9 The shoot of a plant grows towards the light.



Which diagram shows the correct distribution of auxin in this shoot?



- 10 Which features are correct for a wind-pollinated flower?

| | nectar | petals |
|----------|---------|--------|
| A | absent | small |
| B | absent | large |
| C | present | small |
| D | present | large |

- 11 During pregnancy, what protects the embryo against toxins?

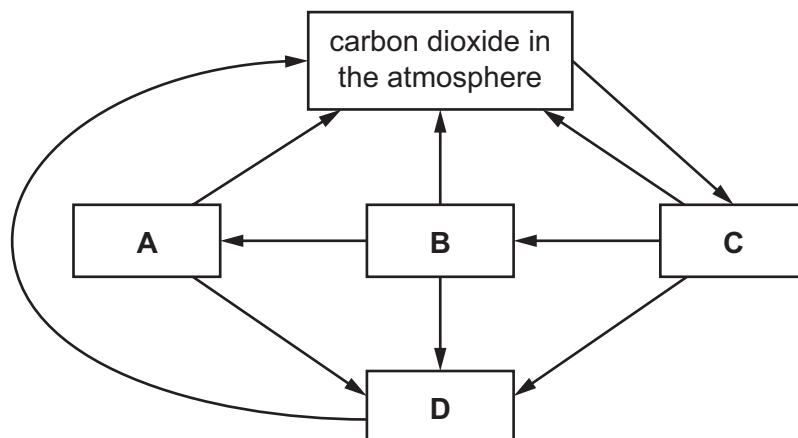
- A** amniotic fluid
- B** amniotic sac
- C** placenta
- D** umbilical cord

- 12 A human eats vegetables.

Which row describes the position of the human in the food chain?

| | consumer | trophic level |
|----------|-----------|---------------|
| A | primary | first |
| B | primary | second |
| C | secondary | first |
| D | secondary | second |

13 Which labelled box represents plants in the carbon cycle?

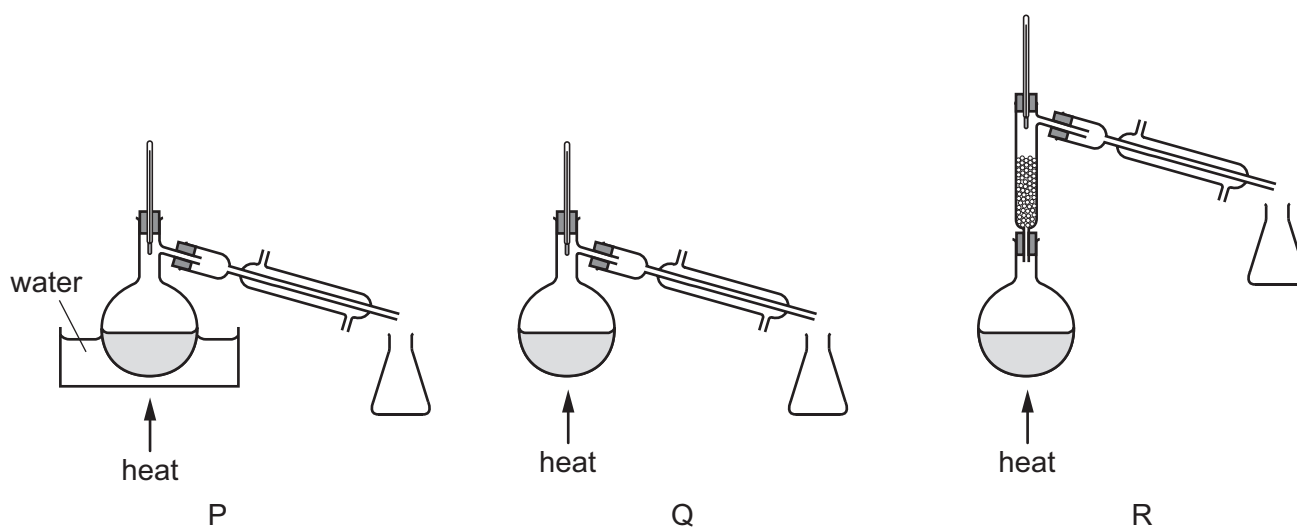


14 A mixture contains two liquids.

One liquid has a boiling point of 120 °C.

The other liquid has a boiling point of 160 °C.

They are separated by fractional distillation.



Which apparatus is used to separate the two liquids?

- A P and Q B P only C Q only D R only

15 Iodine is a non-metal.

It is a solid at room temperature.

What is a property of iodine?

- A It can be stretched into a wire.
- B It is brittle.
- C It is a good conductor of electricity.
- D It is a good conductor of heat.

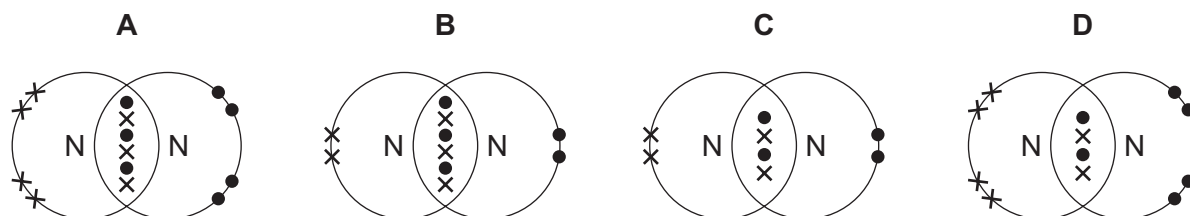
16 The atomic number of argon is 18.

The mass number of argon is 40.

How many protons, neutrons and electrons are in an argon atom?

| | protons | neutrons | electrons |
|---|---------|----------|-----------|
| A | 18 | 22 | 18 |
| B | 18 | 22 | 22 |
| C | 22 | 18 | 18 |
| D | 22 | 18 | 22 |

17 Which dot-and-cross diagram represents the bonding in nitrogen?



18 What happens at the anode during the electrolysis of molten aluminium oxide?

- A Aluminium ions gain electrons to form aluminium atoms.
- B Aluminium ions lose electrons to form aluminium atoms.
- C Oxide ions gain electrons to form oxygen molecules.
- D Oxide ions lose electrons to form oxygen molecules.

19 Steam condenses to form liquid water.

Which row shows the type of reaction and the energy level diagram for this change?

| | type of reaction | energy level diagram |
|----------|------------------|----------------------|
| A | endothermic | |
| B | endothermic | |
| C | exothermic | |
| D | exothermic | |

20 In which reaction is carbon dioxide **not** formed?

- A** adding hydrochloric acid to calcium
- B** adding hydrochloric acid to calcium carbonate
- C** burning coal in air
- D** burning methane in air

21 Which statements about elements in Group I of the Periodic Table are correct?

- 1 They become less reactive going down the group.
- 2 Sodium forms positive ions more easily than lithium.
- 3 Their melting points increase going down the group.
- 4 Rubidium is more dense than sodium.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

22 Which statement about noble gases is correct?

- A** Argon is used in lamps because it gives out a bright light when it is heated.
- B** Helium is used to fill balloons because it is more dense than air.
- C** Krypton forms diatomic molecules because it is an unreactive gas.
- D** Neon is unreactive because it has a full outer shell of electrons.

23 X, Y and Z are three metals.

When Z is heated with the oxide of X, the metal X is formed.

When X is added to a solution of Y^{2+} ions, no reaction takes place.

What is the order of reactivity of the metals?

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

24 Which statement describes the correct order in which two reactions in a blast furnace occur?

- A** Carbon dioxide is reduced, then carbon monoxide is oxidised.
- B** Carbon monoxide is oxidised, then carbon dioxide is reduced.
- C** Carbon monoxide is reduced, then carbon is oxidised.
- D** Iron oxide is reduced, then carbon is oxidised.

25 Which statement about carbon dioxide is correct?

- A Carbon dioxide is the only greenhouse gas.
- B Carbon dioxide makes up approximately 4% of clean air.
- C Increased concentrations of carbon dioxide enhance the greenhouse effect.
- D The only source of carbon dioxide in the air is from motor vehicles.

26 Refinery gas contains methane.

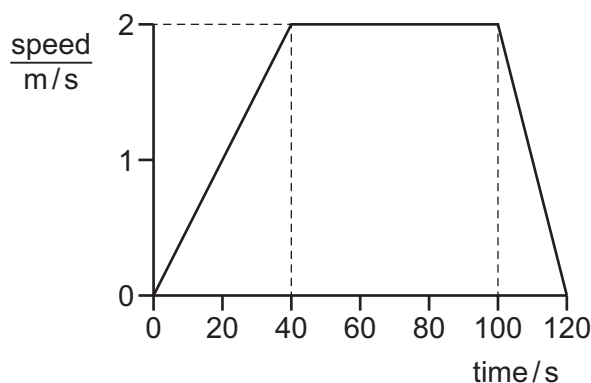
Which statement about methane is correct?

- A Its boiling point is high because it has strong forces of attraction between molecules.
- B Its boiling point is high because it has weak forces of attraction between molecules.
- C Its boiling point is low because it has strong forces of attraction between molecules.
- D Its boiling point is low because it has weak forces of attraction between molecules.

27 Which description identifies the monomer that is used to form poly(ethene) by addition polymerisation?

- A saturated alkane
- B saturated alkene
- C unsaturated alkane
- D unsaturated alkene

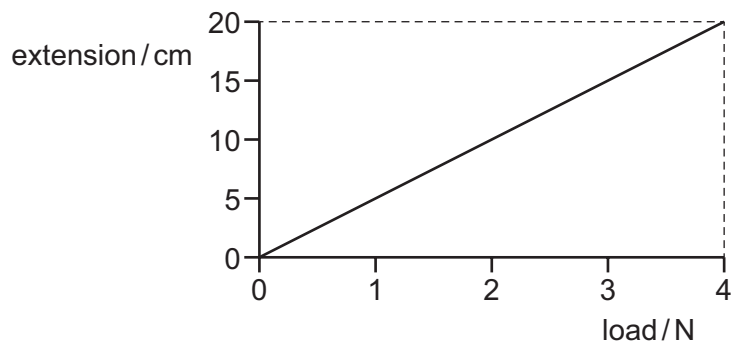
28 A boy walks for 120 s. The graph shows how the speed of the boy varies with time.



What is the distance travelled by the boy while his speed is increasing?

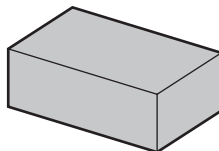
- A 20 m
- B 40 m
- C 80 m
- D 120 m

- 29 The diagram shows an extension–load graph for a spring.



What is the spring constant k of the spring?

- A 0.20 N/cm B 5.0 N/cm C 40 N/cm D 80 N/cm
- 30 A brick of mass m has an area A in contact with the ground.



The gravitational force on unit mass is g .

Which expression gives the pressure on the ground due to the brick?

- A mgA B $\frac{m}{Ag}$ C $\frac{Ag}{m}$ D $\frac{mg}{A}$
- 31 An object of mass m is travelling at speed v at a constant height h above the ground.

Which expressions give the kinetic energy and the gravitational potential energy of the object?

| | kinetic energy | gravitational potential energy |
|----------|---------------------|--------------------------------|
| A | $\frac{1}{2}mv^2$ | $\frac{mg}{h}$ |
| B | $\frac{1}{2}mv^2$ | mgh |
| C | $\frac{1}{2}(mv)^2$ | $\frac{mg}{h}$ |
| D | $\frac{1}{2}(mv)^2$ | mgh |

- 32 A motor is used to lift a load of 3000 N through a vertical distance of 40 m in 2.0 minutes.

How much useful power does the motor produce?

- A 1000 W B 9000 W C 60 000 W D 240 000 W

- 33 Electricity is generated in different power stations that use coal, hydroelectric dams, nuclear fission or geothermal resources.

How is a hydroelectric power station different from the other three types of power station?

- A It is the only power station that uses steam as part of the process.
- B It is the only power station that does not use steam as part of the process.
- C It is the only power station that uses a renewable form of energy.
- D It is the only power station that does not use a renewable form of energy.

- 34 A gas is trapped in a container.

Which properties of the molecules of the gas determine its temperature and its pressure?

| | temperature determined by | pressure determined by |
|---|---------------------------------|--|
| A | the separation of the molecules | how often the molecules collide with the container |
| B | the separation of the molecules | the forces between the molecules |
| C | the speed of the molecules | how often the molecules collide with the container |
| D | the speed of the molecules | the forces between the molecules |

- 35 A wave travels through a substance from point X to point Y. The arrows show the direction in which particles of the substance vibrate.



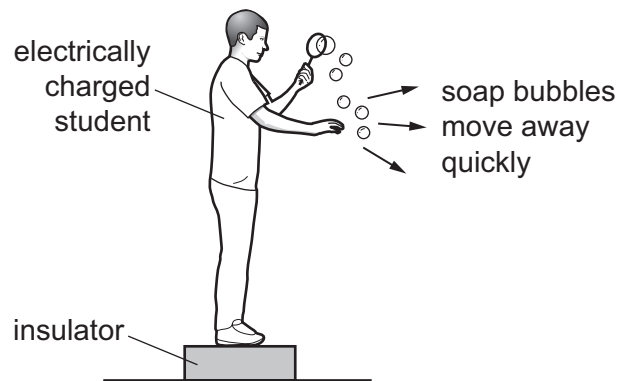
Which row states the type of wave involved and gives an example of this type of wave?

| | type of wave | example |
|---|--------------|---------|
| A | longitudinal | radio |
| B | longitudinal | sound |
| C | transverse | radio |
| D | transverse | sound |

- 36 What is **not** part of the electromagnetic spectrum?

- A gamma-radiation
- B microwaves
- C sound waves
- D X-rays

- 37 An electrically charged student produces soap bubbles. When he holds his hand near the bubbles, they move away quickly from his hand.

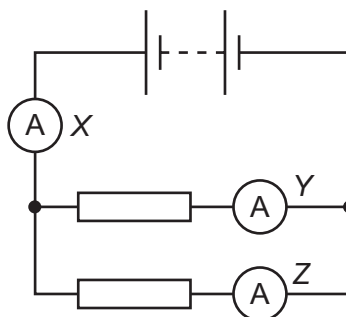


For this movement of the bubbles to happen, which statement is correct?

- A The bubbles must be negatively charged.
 - B The bubbles must be positively charged.
 - C The bubbles must have the opposite charge to the charge on the student.
 - D The bubbles must have the same charge as the charge on the student.
- 38 Which two changes together must cause the resistance of a wire to increase?

| | change in length of wire | change in cross-sectional area of wire |
|----------|--------------------------|--|
| A | decrease | decrease |
| B | decrease | increase |
| C | increase | decrease |
| D | increase | increase |

- 39 The diagram shows a circuit with three ammeters. The readings on the ammeters are X, Y and Z.



Which set of readings on the ammeters is possible?

| | X/A | Y/A | Z/A |
|----------|-----|-----|-----|
| A | 2 | 3 | 5 |
| B | 3 | 2 | 5 |
| C | 3 | 3 | 3 |
| D | 5 | 2 | 3 |

- 40 A worker uses an electric drill continuously for 1.0 hour.

The current in the drill is 5.0 A when connected to the 250 V mains.

How much electrical energy is transferred by the drill?

- A** 1.25 kJ **B** 180 kJ **C** 4500 kJ **D** 5400 kJ

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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.).