



# Cambridge IGCSE™

## CO-ORDINATED SCIENCES

Paper 2 Multiple Choice (Extended)

0654/22

February/March 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 =  $9.8 \text{ m/s}^2$ ).

### 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.

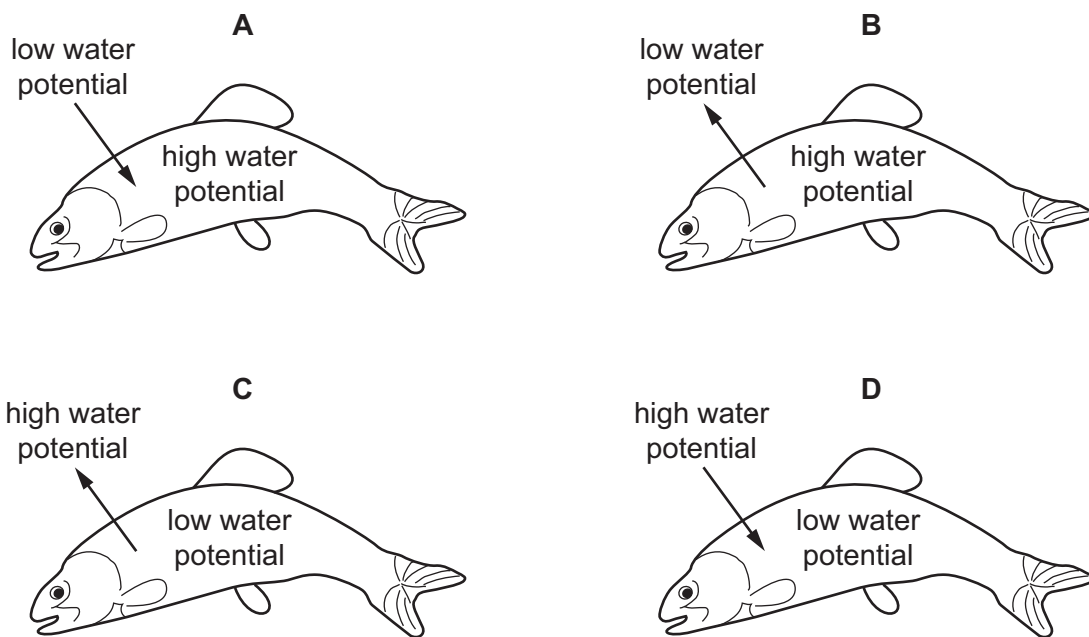


1 Which feature of a red blood cell allows it to transport oxygen?

- A presence of haemoglobin
- B presence of a nucleus
- C small surface area to volume ratio
- D spherical shape

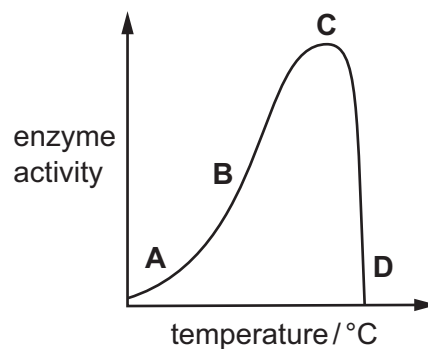
2 A salmon is a fish that can live in both fresh and salt water. Salmon are affected by water movement when the environment changes.

Which diagram shows the internal and external water potential and the movement of water when a salmon is in fresh water?



3 The graph shows the effect of temperature on an enzyme-controlled reaction.

Which point has the highest frequency of effective collisions?

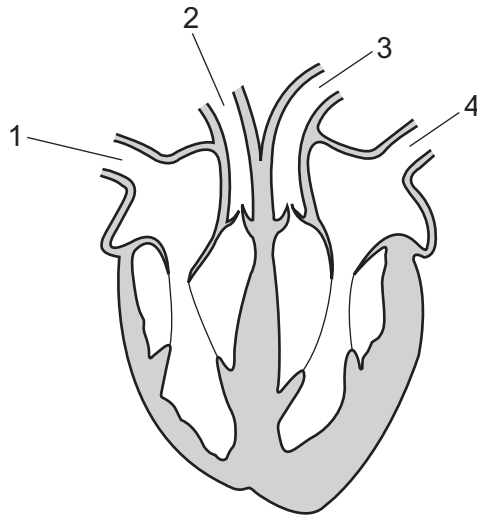


- 4 Plants do **not** grow well when they are deficient in magnesium ions.

What is the reason for this?

- A increased water uptake from the soil
  - B not able to synthesise proteins from carbohydrates
  - C reduced diffusion of carbon dioxide into the leaf
  - D reduced production of chlorophyll
- 5 What is a definition of translocation?
- A the movement of amino acids and sucrose in phloem
  - B the movement of amino acids and sucrose in xylem
  - C the movement of glucose and amino acids in phloem
  - D the movement of glucose and amino acids in xylem

- 6 The diagram shows a section through the human heart.



Which two blood vessels are arteries?

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

- 7 An athlete runs as fast as possible.

After 200 m, the athlete cannot continue and is breathing deeply.

What accumulated in the athlete's muscles?

- A alcohol
- B carbon dioxide
- C lactic acid
- D water

- 8 Which row names a hormone, the organ that produces it and the hormone's effect on blood glucose concentration?

	hormone	produced by	effect on blood glucose concentration
A	glucagon	liver	decreases
B	glucagon	pancreas	increases
C	insulin	liver	decreases
D	insulin	pancreas	increases

- 9 Growing new plants from cuttings is asexual reproduction.

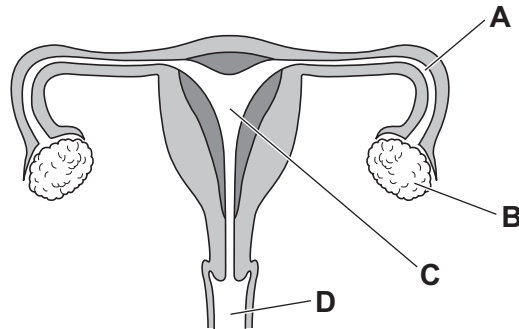
Growing new plants from seeds is sexual reproduction.

Which row is correct for both cuttings and seeds?

	cuttings		seeds	
	nucleus of cells	offspring	nucleus of cells	offspring
A	diploid	genetically different	haploid	genetically identical
B	diploid	genetically identical	diploid	genetically different
C	haploid	genetically different	haploid	genetically different
D	haploid	genetically identical	diploid	genetically identical

- 10 The diagram shows the human female reproductive system.

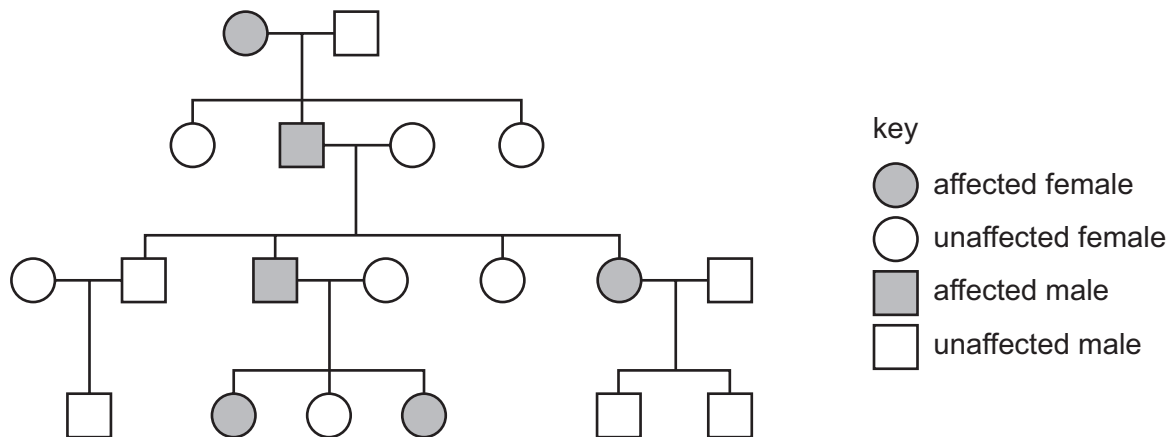
Which label shows the oviduct?



- 11 What is homeostasis?

- A the maintenance of the body's external environment
- B the maintenance of the body's internal environment
- C the processes that produce heat in the body
- D the removal of waste from the body

- 12 Polydactyly is a condition that causes babies to be born with extra fingers or toes. The allele that causes polydactyly is dominant.



How many individuals on the pedigree diagram are heterozygous for polydactyly?

- A 5
- B 6
- C 7
- D 8

- 13 What could be a result of deforestation?

- A a decrease in flooding because there are fewer tree roots
- B an increase in carbon dioxide because there are fewer tree leaves respiring
- C a decrease in soil loss because there are fewer tree roots
- D an increase in extinction because there are fewer habitats

14 Which row compares the rates of diffusion of fluorine and hydrogen?

	diffuses faster	reason
<b>A</b>	fluorine	higher molecular mass
<b>B</b>	fluorine	lower molecular mass
<b>C</b>	hydrogen	lower molecular mass
<b>D</b>	hydrogen	higher molecular mass

15 The symbols representing four different particles are shown.



Which particles have the same chemical properties?

- A**  ${}^1_1\text{P}$  and  ${}^2_1\text{R}$  only
- B**  ${}^2_1\text{Q}^-$  and  ${}^3_1\text{S}^+$  only
- C**  ${}^2_1\text{Q}^-$  and  ${}^2_1\text{R}$  only
- D**  ${}^1_1\text{P}$ ,  ${}^2_1\text{Q}^-$ ,  ${}^2_1\text{R}$  and  ${}^3_1\text{S}^+$

16 Copper reacts with dilute nitric acid to form copper(II) nitrate, nitrogen dioxide and water.

The equation for the reaction is shown.



Which row shows the numerical values of  $q$  and  $s$ ?

	$q$	$s$
<b>A</b>	2	1
<b>B</b>	2	2
<b>C</b>	4	1
<b>D</b>	4	2

17 A fixed mass of zinc reacts with 100 cm<sup>3</sup> of dilute sulfuric acid.

Which row identifies changes that increase the rate of the reaction?

	change to the size of the zinc particles	change to the acid
<b>A</b>	decrease	decrease the concentration
<b>B</b>	decrease	increase the temperature
<b>C</b>	increase	decrease the temperature
<b>D</b>	increase	increase the concentration

18 Which row describes chemical properties of dilute hydrochloric acid?

	effect on litmus paper	produces a gas when added to a metal carbonate
<b>A</b>	turns red litmus blue	no
<b>B</b>	turns blue litmus red	no
<b>C</b>	turns red litmus blue	yes
<b>D</b>	turns blue litmus red	yes

19 Which row describes metallic oxides and non-metallic oxides?

	metallic oxides	non-metallic oxides
<b>A</b>	acidic	acidic
<b>B</b>	acidic	basic
<b>C</b>	basic	acidic
<b>D</b>	basic	basic

20 Which row describes the trends shown by the Group I elements lithium to potassium?

	trend in melting point	trend in reaction with water
<b>A</b>	decrease	decrease
<b>B</b>	decrease	increase
<b>C</b>	increase	decrease
<b>D</b>	increase	increase

**21** Bromine has a boiling point of 59 °C. It reacts with hydrogen rapidly.

Iodine has a boiling point of 184 °C. It reacts with hydrogen slowly.

Which row about fluorine is correct?

	boiling point / °C	reaction with hydrogen
<b>A</b>	−188	explosive
<b>B</b>	−188	very slow
<b>C</b>	114	explosive
<b>D</b>	114	very slow

**22** Which statements explain why zinc is used to galvanise steel?

- 1 It is less reactive than steel.
- 2 It forms an alloy with steel.
- 3 It prevents air and water coming into contact with steel.
- 4 It provides sacrificial protection for the steel.

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

**23** The ore cassiterite contains tin dioxide.

Tin is more reactive than copper but less reactive than iron.

Which row shows the industrial method used to extract tin based on tin's position in the reactivity series?

	using carbon in a blast furnace	electrolysis
<b>A</b>	yes	yes
<b>B</b>	yes	no
<b>C</b>	no	yes
<b>D</b>	no	no



24 Which statements about global warming are correct?

- 1 Global warming contributes to climate change.
- 2 Methane is a greenhouse gas.
- 3 Decreasing concentrations of greenhouse gases in the atmosphere cause global warming.
- 4 Carbon is a greenhouse gas.

**A** 1 and 2

**B** 1 and 4

**C** 2 and 3

**D** 3 and 4

25 What is the main constituent of natural gas?

**A** ethane

**B** ethene

**C** methane

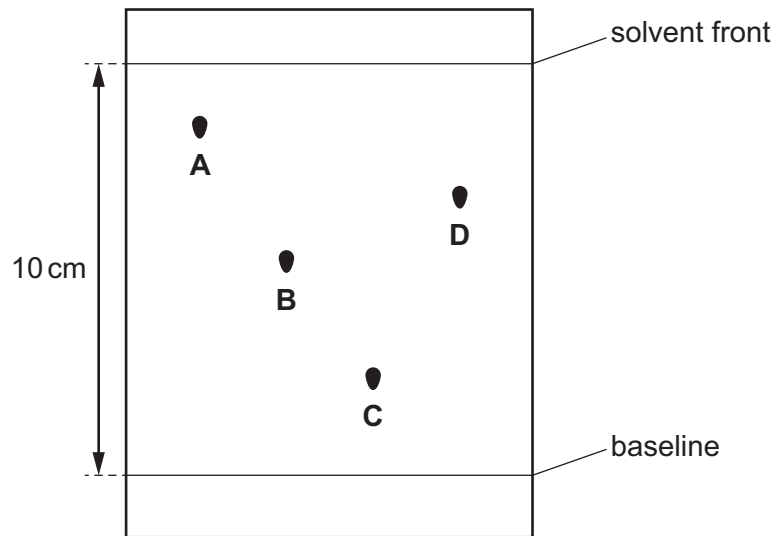
**D** nitrogen

26 Which row shows the structure of poly(ethene) and the type of polymerisation used to make it?

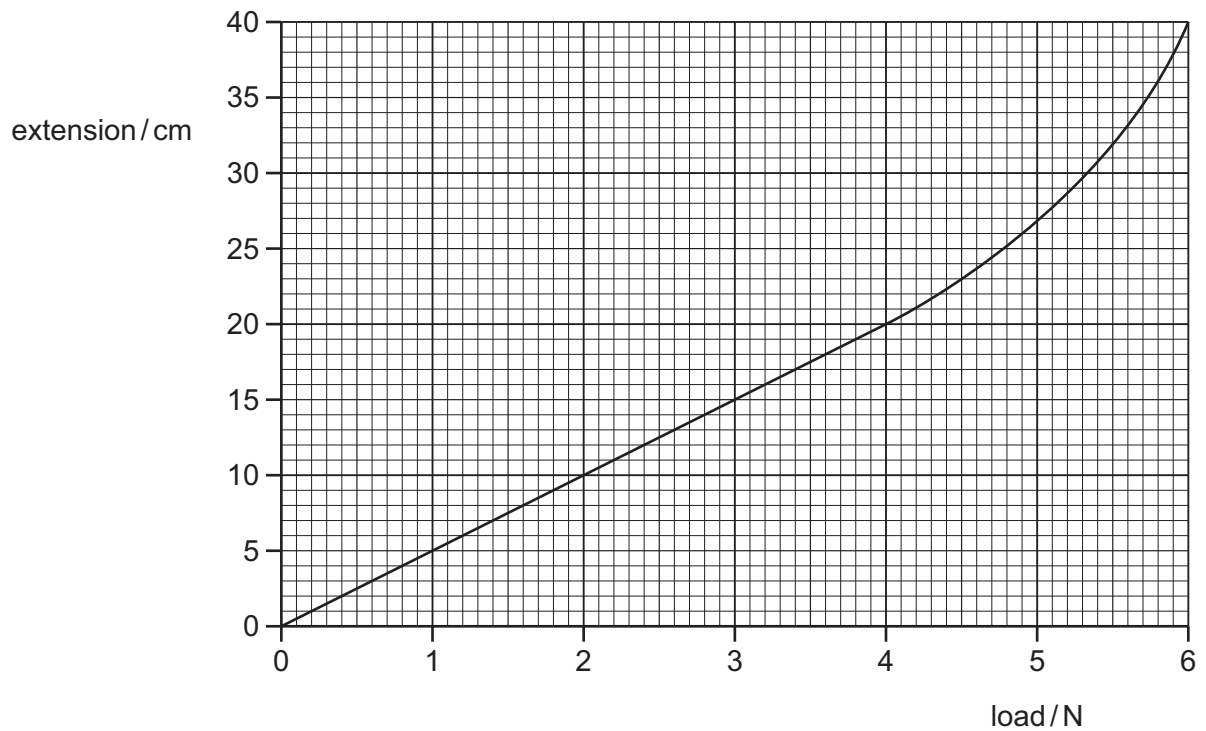
	structure of polymer	type of polymerisation
<b>A</b>	$\left[ \begin{array}{c} \text{O} & & \text{O} \\ \parallel & & \parallel \\ -\text{C}-\square-\text{C}-\text{N}-\square-\text{N}- \\   & &   \\ \text{H} & & \text{H} \end{array} \right]_n$	addition
<b>B</b>	$\left[ \begin{array}{c} \text{O} & & \text{O} \\ \parallel & & \parallel \\ -\text{C}-\square-\text{C}-\text{N}-\square-\text{N}- \\   & &   \\ \text{H} & & \text{H} \end{array} \right]_n$	condensation
<b>C</b>	$\left[ \begin{array}{cc} \text{H} & \text{H} \\   &   \\ -\text{C} & -\text{C}- \\   &   \\ \text{H} & \text{H} \end{array} \right]_n$	addition
<b>D</b>	$\left[ \begin{array}{cc} \text{H} & \text{H} \\   &   \\ -\text{C} & -\text{C}- \\   &   \\ \text{H} & \text{H} \end{array} \right]_n$	condensation

27 The chromatogram of four different inks is shown.

Which ink has an  $R_f$  value of 0.53?



28 The graph shows how the extension in cm of a spring changes with the load applied to it.

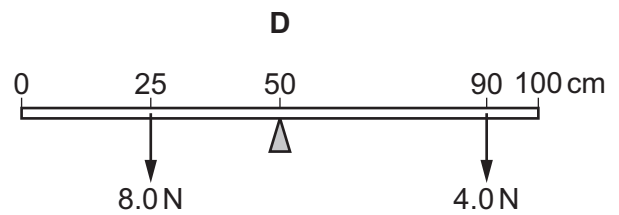
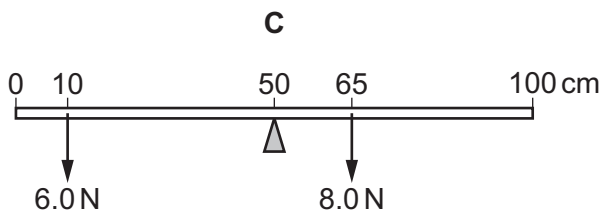
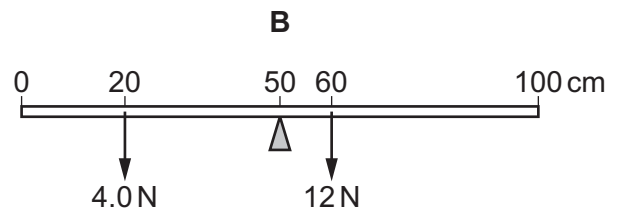
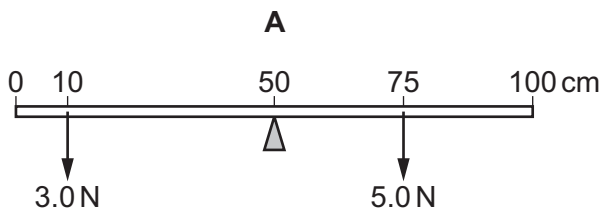


What is the spring constant of this spring in N/m?

- A** 0.16 N/m      **B** 0.20 N/m      **C** 16 N/m      **D** 20 N/m

- 29** The diagrams show uniform metre rulers each pivoted at the 50 cm mark. Different weights are placed on the rulers at different distances from the 0 cm end.

Which ruler rotates in a clockwise direction?



- 30** Which expression gives the kinetic energy of an object of mass  $m$  travelling at speed  $v$ ?

- A**  $\frac{1}{2} \times m \times v$   
**B**  $\frac{1}{2} \times m \times v^2$   
**C**  $\frac{1}{2} \times (m \times v)^2$   
**D**  $(\frac{1}{2} \times m \times v)^2$

- 31** Gas is trapped in a container.

The piston is moved to the right. The temperature of the gas does not change.



Which statement about the gas is correct?

- A** The kinetic energy of the gas particles decreases.  
**B** The kinetic energy of the gas particles increases.  
**C** The pressure of the gas decreases.  
**D** The pressure of the gas increases.

- 32 Which method of thermal energy transfer occurs in a vacuum and which region of the electromagnetic spectrum is mainly involved in this type of thermal energy transfer?

	method of thermal energy transfer	region of the electromagnetic spectrum
<b>A</b>	convection	infrared
<b>B</b>	convection	radio waves
<b>C</b>	radiation	infrared
<b>D</b>	radiation	radio waves

- 33 Four rods have the same dimensions. They are made of four different metals and are all at room temperature.

All the rods are heated equally at one end for the same time.

The final temperature of the other end of each rod is shown in the table.

Which rod is the worst conductor of heat?

	final temperature / °C
<b>A</b>	50
<b>B</b>	62
<b>C</b>	70
<b>D</b>	82

- 34 Which statements about electromagnetic waves are correct?

- 1 The frequency of the waves increases as the wavelength increases.
- 2 The speed of the waves in a vacuum is 300 000 000 m/s.
- 3 Electromagnetic waves are transverse.

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

- 35 Which statement about real and virtual images formed by a thin converging lens is correct?

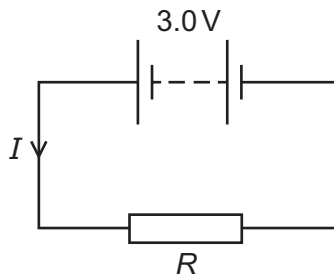
- A** All real images are enlarged and inverted.  
**B** All real images can be produced on a screen.  
**C** All virtual images are diminished and upright.  
**D** All virtual images can be produced on a screen.

- 36 A guitar produces a loud sound with a low pitch.

Which description of the sound wave produced by the guitar is correct?

- A It has a large amplitude and a large frequency.
- B It has a large amplitude and a small frequency.
- C It has a small amplitude and a large frequency.
- D It has a small amplitude and a small frequency.

- 37 A 3.0 V battery is connected to a resistor of resistance  $R$ . The current in the resistor is  $I$ .



Which row gives possible values of  $I$  and of  $R$ ?

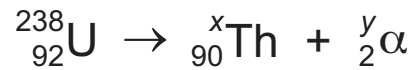
	$I/\text{A}$	$R/\Omega$
<b>A</b>	1.5	1.5
<b>B</b>	1.5	2.0
<b>C</b>	6.0	2.0
<b>D</b>	4.0	12

- 38 When electricity is generated in a power station, a step-up transformer is used before it is transmitted around the country.

Which statement explains why a step-up transformer is used?

- A The current decreases, the voltage increases so more energy is transferred by heating in the transmission cables.
- B The current increases, the voltage decreases so less energy is transferred by heating in the transmission cables.
- C The voltage decreases, the current increases so more energy is transferred by heating in the transmission cables.
- D The voltage increases, the current decreases so less energy is transferred by heating in the transmission cables.

- 39 The isotope uranium-238 (U) decays by alpha emission to thorium (Th). The decay equation is shown.



What are  $x$  and  $y$ ?

	$x$	$y$
<b>A</b>	234	4
<b>B</b>	236	2
<b>C</b>	240	2
<b>D</b>	242	4

- 40 In the Solar System, a planet orbits around the Sun. The radius of the orbit is  $r$  and the orbital period is  $T$ .

Which equation gives the orbital speed  $v$ ?

**A**  $v = \frac{2\pi T}{r}$      
 **B**  $v = \frac{r}{2\pi T}$      
 **C**  $v = \frac{2\pi r}{T}$      
 **D**  $v = \frac{2\pi}{rT}$

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The Periodic Table of Elements

Group												
I	II						III	IV	V	VI	VII	VIII
<div>1 H hydrogen 1</div>												
<div>2 He helium 4</div>												
<div>3 Li lithium 7</div>												
<div>4 Be beryllium 9</div>												
<div>5 B boron 11</div>												
<div>6 C carbon 12</div>												
<div>7 N nitrogen 14</div>												
<div>8 O oxygen 16</div>												
<div>9 F fluorine 19</div>												
<div>10 Ne neon 20</div>												
<div>11 Na sodium 23</div>												
<div>12 Mg magnesium 24</div>												
<div>13 Al aluminium 27</div>												
<div>14 Si silicon 28</div>												
<div>15 P phosphorus 31</div>												
<div>16 S sulfur 32</div>												
<div>17 Cl chlorine 35.5</div>												
<div>18 Ar argon 40</div>												
<div>19 K potassium 39</div>												
<div>20 Ca calcium 40</div>												
<div>21 Sc scandium 45</div>												
<div>22 Ti titanium 48</div>												
<div>23 V vanadium 51</div>												
<div>24 Cr chromium 52</div>												
<div>25 Mn manganese 55</div>												
<div>26 Fe iron 56</div>												
<div>27 Co cobalt 59</div>												
<div>28 Ni nickel 59</div>												
<div>29 Cu copper 64</div>												
<div>30 Zn zinc 65</div>												
<div>31 Ga gallium 70</div>												
<div>32 Ge germanium 73</div>												
<div>33 As arsenic 75</div>												
<div>34 Se selenium 79</div>												
<div>35 Br bromine 80</div>												
<div>36 Kr krypton 84</div>												
<div>37 Rb rubidium 85</div>												
<div>38 Sr strontium 88</div>												
<div>39 Y yttrium 89</div>												
<div>40 Zr zirconium 91</div>												
<div>41 Nb niobium 93</div>												
<div>42 Mo molybdenum 96</div>												
<div>43 Tc technetium —</div>												
<div>44 Ru ruthenium 101</div>												
<div>45 Rh rhodium 103</div>												
<div>46 Pd palladium 106</div>												
<div>47 Ag silver 108</div>												
<div>48 Cd cadmium 112</div>												
<div>49 In indium 115</div>												
<div>50 Sn tin 119</div>												
<div>51 Sb antimony 122</div>												
<div>52 Te tellurium 128</div>												
<div>53 I iodine 127</div>												
<div>54 Xe xenon 131</div>												
<div>55 Cs caesium 133</div>												
<div>56 Ba barium 137</div>												
<div>57–71 lanthanoids</div>												
<div>72 Hf hafnium 178</div>												
<div>73 Ta tantalum 181</div>												
<div>74 W tungsten 184</div>												
<div>75 Re rhenium 186</div>												
<div>76 Os osmium 190</div>												
<div>77 Ir iridium 192</div>												
<div>78 Pt platinum 195</div>												
<div>79 Au gold 197</div>												
<div>80 Hg mercury 201</div>												
<div>81 Tl thallium 204</div>												
<div>82 Pb lead 207</div>												
<div>83 Bi bismuth 209</div>												
<div>84 Po polonium —</div>												
<div>85 At astatine —</div>												
<div>86 Rn radon —</div>												
<div>87 Fr francium —</div>												
<div>88 Ra radium —</div>												
<div>89–103 actinoids</div>												
<div>104 Rf rutherfordium —</div>												
<div>105 Db dubnium —</div>												
<div>106 Sg seaborgium —</div>												
<div>107 Bh bohrium —</div>												
<div>108 Hs hassium —</div>												
<div>109 Mt meitnerium —</div>												
<div>110 Ds darmstadtium —</div>												
<div>111 Rg roentgenium —</div>												
<div>112 Cn copernicium —</div>												
<div>113 Nh nihonium —</div>												
<div>114 Fl flerovium —</div>												
<div>115 Mc moscovium —</div>												
<div>116 Lv livermorium —</div>												
<div>117 Ts tennessine —</div>												
<div>118 Og oganeson —</div>												