Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/21**

Paper 2 Multiple Choice (Extended) **May/June 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.
Electronic calculators may be used.

This document consists of **14** printed pages and **2** blank pages.

1 Which structural feature is found in a plant cell but **not** in an animal cell?

A cell membrane

B cell wall

C cytoplasm

D nucleus

2 What is the order of decreasing diameter of the structures found in the breathing system?

A alveoli → bronchi → capillaries

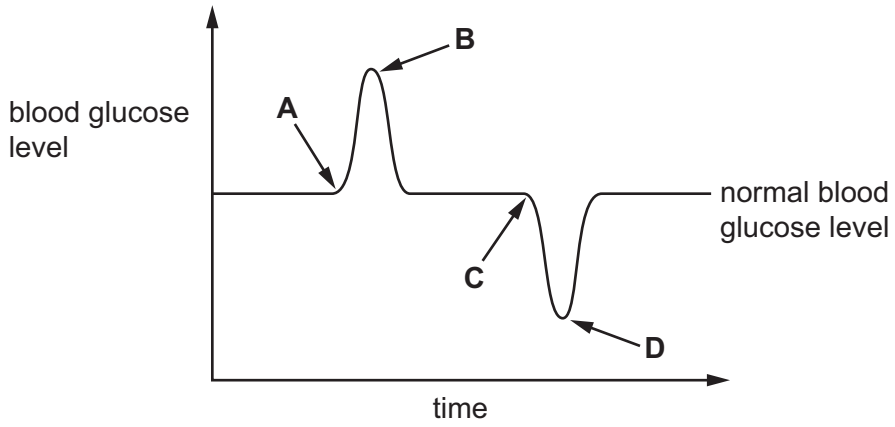
B alveoli → capillaries → bronchi

C bronchi → alveoli → capillaries

D capillaries → bronchi → alveoli

3 The graph shows the change in blood glucose level in a healthy man.

Which arrow identifies when the pancreas first starts to release glucagon?



4 In a plant, what leads to offspring that are identical to the parent?

A asexual reproduction

B insect pollination

C seed germination

D sexual reproduction

5 A frightened animal may need to run away suddenly.

Which substance is released to stimulate an increase in blood glucose concentration?

A adrenaline

B haemoglobin

C plasma

D platelets

6 What is the function of microorganisms in yoghurt making?

A They make the sugar in milk become solid.

B They produce lactic acid.

C They raise the pH of the mixture.

D They reduce the fat content of the milk.

7 What is an ecosystem?

A a chart showing the flow of energy from one organism to another

B a diagram giving the energy level of an organism in its environment

C a network of interconnected organisms

D a unit containing all of the organisms and their environment

8 What is meant by osmosis?

A The diffusion of water molecules from a region of their higher concentration to a region of their lower concentration as a result of their random movement.

B The diffusion of water molecules from a region of their higher concentration to a region of their lower concentration through a partially permeable membrane.

C The diffusion of water molecules from a region of their lower concentration to a region of their higher concentration as a result of their random movement.

D The diffusion of water molecules from a region of their lower concentration to a region of their higher concentration through a partially permeable membrane.

9 What is meant by the term *homozygous*?

A alleles that determine the appearance of an organism

B an allele that is effective only when there is no dominant allele present

C an individual with two alleles of the same gene that are identical

D an individual with two different alleles of the same gene

10 The ribs are lowered as we breathe out.

Which characteristic of living organisms does this illustrate?

A growth

B movement

C respiration

D sensitivity

11 Some human white blood cells produce antibodies.

What is another function of white blood cells?

A enzyme secretion

B hormone production

C peristalsis

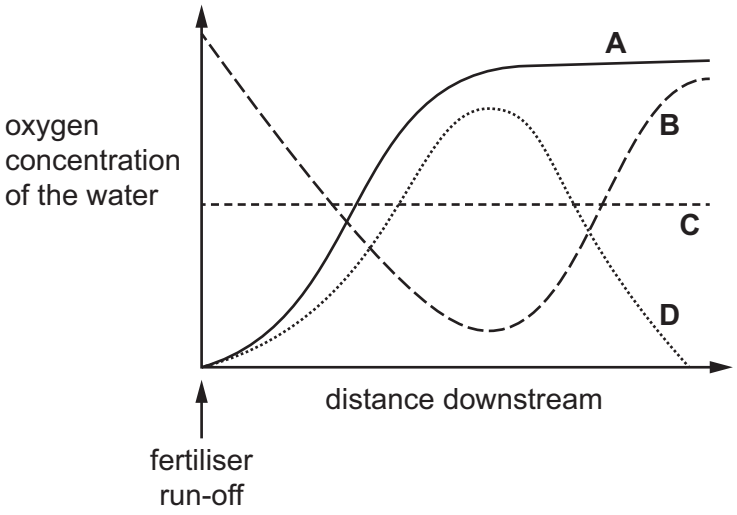
D phagocytosis

12 A scientist took a single living cheek cell from each of 30 different people. 15 of these people were male and 15 were female. He stained each cell so that the sex chromosomes could be observed.

How many X chromosomes would the scientist observe?

A 15 **B** 30 **C** 45 **D** 60

13 Which line shows how the oxygen concentration of the water changes after excess fertiliser has entered a stream?



14 Which statement describes how magnesium atoms and nitrogen atoms combine to form magnesium nitride, Mg_3N_2?

A Each magnesium atom loses three electrons and each nitrogen atom gains two electrons.

B Each magnesium atom loses two electrons and each nitrogen atom gains three electrons.

C Each nitrogen atom loses three electrons and each magnesium atom gains two electrons.

D Each nitrogen atom loses two electrons and each magnesium atom gains three electrons.

15 How many atoms of metals and of non-metals are shown in the formula Na_2SO_4?

	atoms of metals	atoms of non-metals
A	1	1
B	1	2
C	2	4
D	2	5

16 Aqueous copper(II) sulfate is electrolysed using carbon electrodes.

What is produced at each electrode?

	anode	cathode
A	copper	oxygen
B	hydrogen	copper
C	oxygen	copper
D	oxygen	hydrogen

17 Aqueous sodium thiosulfate reacts with dilute hydrochloric acid.

Increasing the concentration of sodium thiosulfate increases the rate of reaction.

Which statement explains this observation?

A The particles are closer together and collide more frequently.

B The particles are closer together and collide with more energy.

C The particles have a greater surface area and collide more frequently.

D The particles have more energy and collide more frequently.

18 Aluminium reacts with iron(III) oxide, forming iron.

The equation for this reaction is shown.

$$\text{aluminium} + \text{iron(III) oxide} \rightarrow \text{iron} + \text{aluminium oxide}$$

Which statement explains why this is a redox reaction?

A Aluminium gains oxygen and iron loses oxygen.

B Aluminium is reduced and iron(III) oxide is oxidised.

C Aluminium oxide is oxidised and iron is reduced.

D Iron gains oxygen and aluminium loses oxygen.

19 The pH of water changes when ammonia is bubbled into it.

What happens to the pH and why?

	pH	ammonia is
A	decreases	acidic
B	decreases	alkaline
C	increases	acidic
D	increases	alkaline

20 In which industrial process is sulfuric acid made?

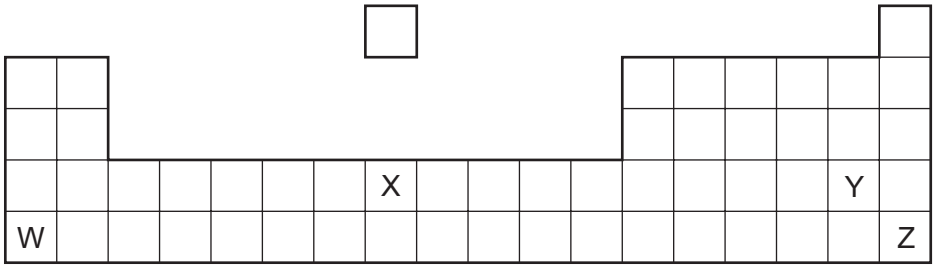
A the catalytic cracking of alkanes

B the Contact process

C the production of iron

D the thermal decomposition of limestone

21 Part of the Periodic Table is shown.



Which description is correct?

A W is a soft solid at room temperature. It has a low melting point and it can act as a catalyst.

B X is a solid at room temperature. It has a high melting point and it can act as a catalyst.

C Y is a solid at room temperature. It forms a coloured vapour and it displaces iodide ions.

D Z is a gas at room temperature. It is very reactive and it has a low boiling point.

22 Which element is used to extract some metals from their ores?

A carbon

B copper

C iron

D nitrogen

23 Four solutions are tested with Universal Indicator paper and with anhydrous copper(II) sulfate.

Which row shows the observations for pure water?

	Universal Indicator paper	anhydrous copper(II) sulfate
A	turns blue	turns blue
B	turns blue	turns white
C	turns green	turns blue
D	turns green	turns white

[Turn over

24 The Haber process is used to make ammonia.

Which statement about the Haber process is **not** correct?

A A vanadium(V) oxide catalyst is used.

B The nitrogen used is obtained from the air.

C The pressure used is 200 atmospheres.

D The temperature used is 450 °C.

25 Why do farmers add lime to soil?

A It acts as a fertiliser.

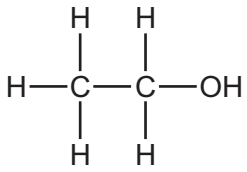
B It adds nitrogen to the soil.

C It decreases the pH of the soil.

D It increases the pH of the soil.

26 Which substance is **not** a product of an addition reaction of ethene?

A



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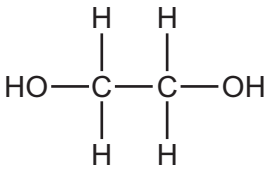

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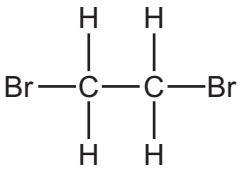

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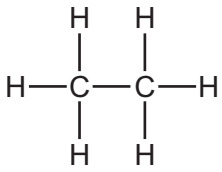


27 Which statement about a protein is **not** correct?

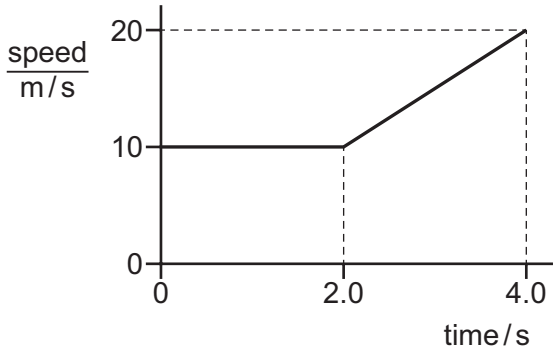
A It can be hydrolysed by acids and by alkalis.

B It is a natural macromolecule.

C It is made from only one monomer.

D It possesses the same amide linkages as nylon.

28 The diagram is a speed-time graph for a moving object.



What is the distance travelled by the object in 4.0 s?

A 30 m **B** 40 m **C** 50 m **D** 80 m

29 What is the name given to the gravitational force of the Earth on an object?

A mass

B power

C volume

D weight

30 A spring of unstretched length 5.0 cm has a spring constant k of 20 N / cm. A load is suspended from the spring and its new length is 8.5 cm.

What is the weight of the load?

A 0.70 N **B** 1.7 N **C** 70 N **D** 170 N

31 The list contains three energy resources, P, Q and R.

P geothermal energy from hot rocks

Q nuclear fission in reactors

R sunlight on solar panels

Which of these resources are renewable?

A P, Q and R

B P and Q only

C P and R only

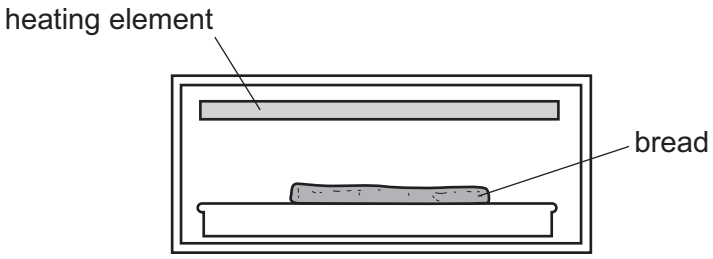
D Q and R only

32 A gas trapped in a cylinder has volume V. The pressure of the gas increases from P to $4P$ at constant temperature.

What is the new volume of the gas?

A $0.25V$ **B** $0.50V$ **C** $2V$ **D** $4V$

33 Bread can be cooked by placing it below a heating element.



Which process transfers thermal energy from the heating element to the bread?

A conduction

B convection

C evaporation

D radiation

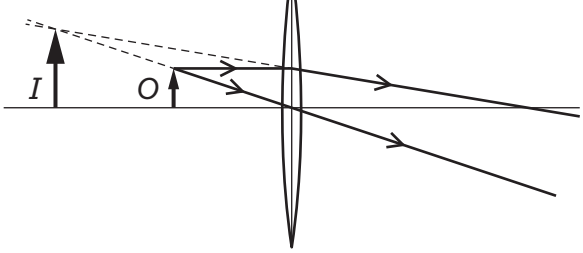
34 Every 10 s a drop of water falls into a pool. The drops cause a circular wave to spread over the surface of the pool at a speed of 20 cm / s.

What is the wavelength of the wave?

A 0.50 cm **B** 2.0 cm **C** 10 cm **D** 200 cm

35 Which ray diagram represents the formation of a virtual image *I* of an object *O?*

A



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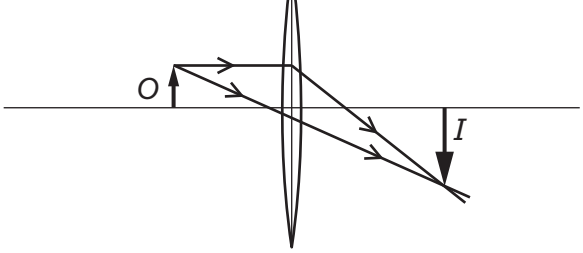

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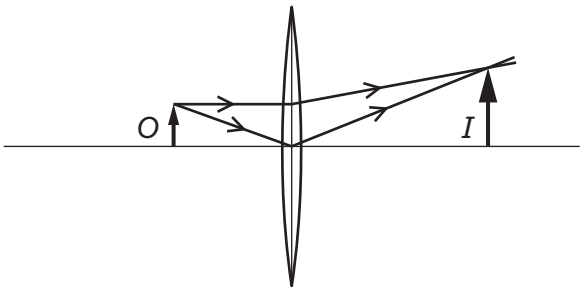

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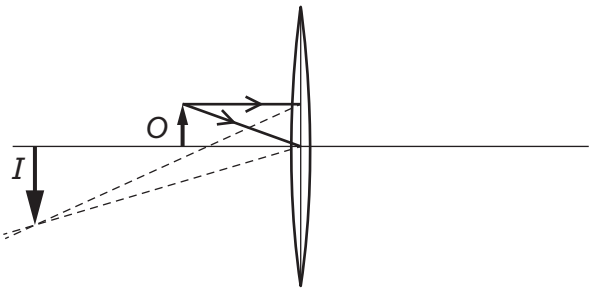
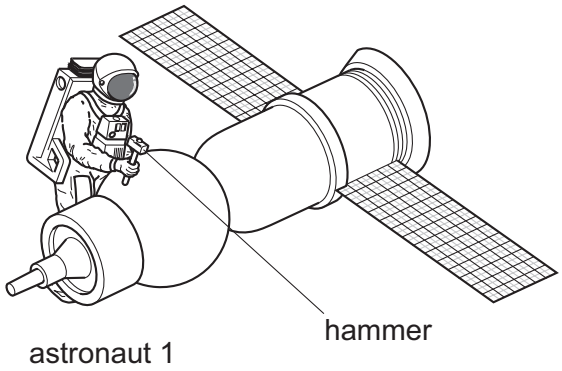


36 Astronaut 1 uses a hammer to mend a satellite in space. Astronaut 2 is nearby. There is no air in space.



What does astronaut 2 hear compared with the sound heard if they were working on Earth?

A a louder sound

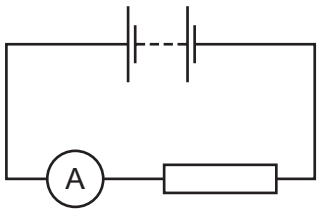
B a quieter sound

C a sound of the same loudness

D no sound at all

37 A battery is connected to an ammeter and a resistor of resistance $1.5 \times 10^3\,\Omega$.

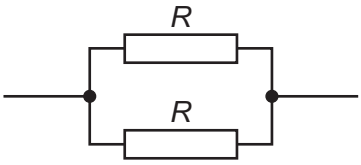
The reading on the ammeter is 3.0 mA.



What is the potential difference (p.d.) across the battery?

A 0.50 V **B** 1.5 V **C** 2.0 V **D** 4.5 V

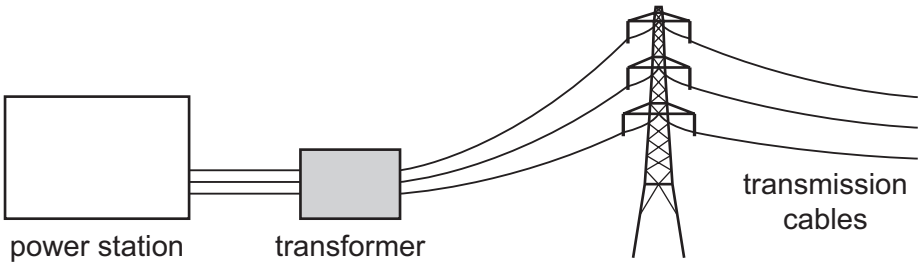
38 Two identical resistors, each of resistance *R*, are connected as shown.



What is their effective resistance?

A $\frac{R}{4}$ **B** $\frac{R}{2}$ **C** $2R$ **D** $4R$

39 Electricity from a power station is to be transmitted over a large distance. A 100% efficient transformer is used near to the power station. This transformer reduces the amount of energy that is wasted thermally in the transmission cables.



How does the transformer reduce the energy loss?

A It decreases the power transmitted so the current and the voltage are both larger.

B It decreases the power transmitted so the current and the voltage are both smaller.

C It increases the current so the voltage is smaller.

D It increases the voltage so the current is smaller.

40 Which row compares the number of protons and the number of neutrons in atoms of different isotopes of an element?

	number of protons	number of neutrons
A	different	different
B	different	the same
C	the same	different
D	the same	the same

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).