

## **CO-ORDINATED SCIENCES**

Paper 2 Multiple Choice (Extended)

0654/21 May/June 2017 45 minutes

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

## **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.

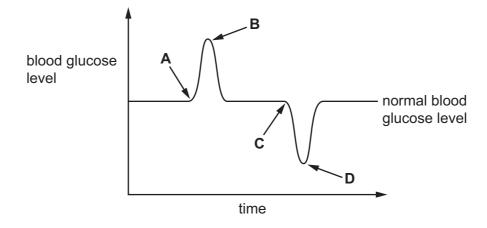
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet. A copy of the Periodic Table is printed on page 16. Electronic calculators may be used.

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?
  - $\textbf{A} \quad alveoli \rightarrow bronchi \rightarrow capillaries$
  - $\textbf{B} \quad \text{alveoli} \rightarrow \text{capillaries} \rightarrow \text{bronchi}$
  - $\textbf{C} \quad \text{bronchi} \rightarrow \text{alveoli} \rightarrow \text{capillaries}$
  - $\textbf{D} \quad \text{capillaries} \rightarrow \text{bronchi} \rightarrow \text{alveoli}$
- 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.

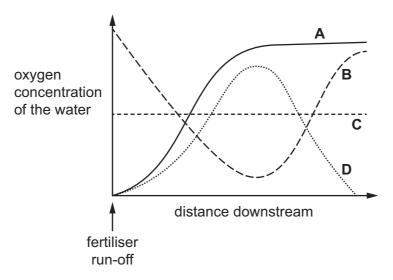
What is another function of white blood cells?

- **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?

Α	15	В	30	С	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<sub>3</sub>N<sub>2</sub>?
  - 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<sub>2</sub>SO<sub>4</sub>?

	atoms of metals	atoms of non-metals
Α	1	1
в	1	2
С	2	4
D	2	5

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

What is produced at each electrode?

	anode	cathode
Α	copper	oxygen
В	hydrogen	copper
С	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.

aluminium + iron(III) oxide  $\rightarrow$  iron + aluminium oxide

Which statement explains why this is a redox reaction?

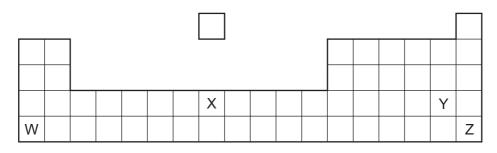
- A Aluminium gains oxygen and iron loses oxygen.
- **B** Aluminium is reduced and iron(III) oxide is oxidised.
- **C** Aluminium oxide is oxidised and iron is reduced.
- **D** Iron gains oxygen and aluminium loses oxygen.
- **19** The pH of water changes when ammonia is bubbled into it.

What happens to the pH and why?

	pН	ammonia is
Α	decreases	acidic
в	decreases	alkaline
С	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.

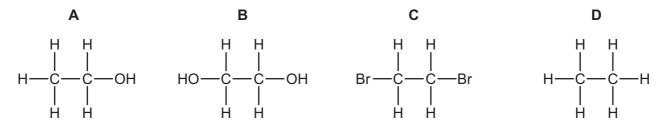
Which row shows the observations for pure water?

	Universal Indicator paper	anhydrous copper(II) sulfate
Α	turns blue	turns blue
в	turns blue	turns white
С	turns green	turns blue
D	turns green	turns white

24 The Haber process is used to make ammonia.

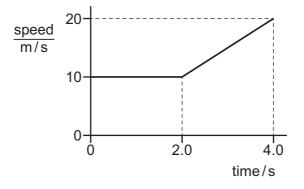
Which statement about the Haber process is not correct?

- **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?



- 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 20N/cm. A load is suspended from the spring and its new length is 8.5 cm.

What is the weight of the load?

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

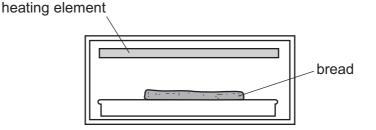
Which of these resources are renewable?

- 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 4*P* 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.

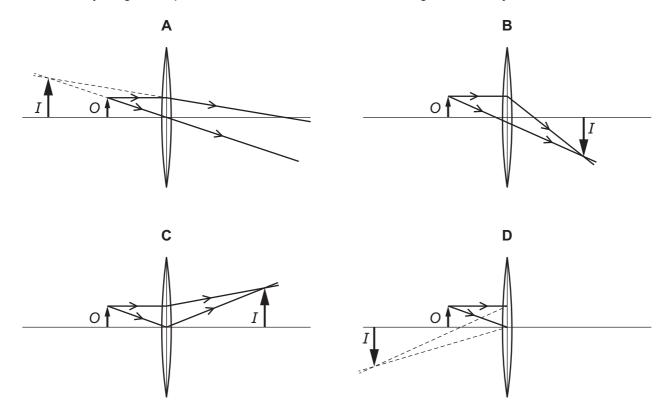


Which process transfers thermal energy from the heating element to the bread?

- 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.

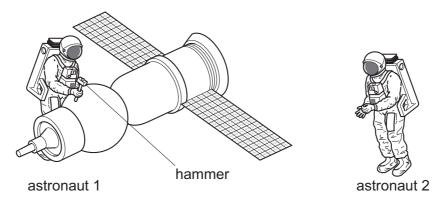
What is the wavelength of the wave?

**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?

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

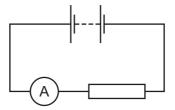


What does astronaut 2 hear compared with the sound heard if they were working on Earth?

- **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  $1.5 \times 10^3 \Omega$ .

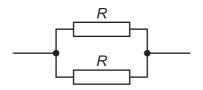
The reading on the ammeter is 3.0 mA.



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

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

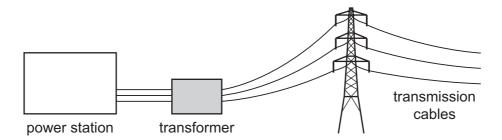
**38** Two identical resistors, each of resistance *R*, are connected as shown.



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
Α	different	different
в	different	the same
С	the same	different
D	the same	the same

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The Periodic Table of Elements

	VIII	2	He	helium 4	10	Ne	neon 20	18	Ar	argon 40	36	Кr	krypton 84	54	Xe	xenon 131	86	Rn	radon	1		
	١١٨				6	ш	fluorine 19	17	Cl	chlorine 35.5	35	Ъ	bromine 80	53	Ι	iodine 127	85	At	astatine	1		
	١٨				œ	0	oxygen 16	16	ა	sulfur 32	34	Se	selenium 79	52	Те	tellurium 128	84	Ро	polonium	- 116	Ľ	livermorium -
	~				7	z	nitrogen 14	15	٩	phosphorus 31	33	As	arsenic 75	51	Sb	antimony 122	83	Bi	bismuth	503		
	$\sim$				9	ပ	carbon 12	14	Si	silicon 28	32	Ge	germanium 73	50	Sn	tin 119	82	Pb	lead	114	FΙ	flerovium -
	Ш				5	Ш	boron 11	13	Ρl	aluminium 27	31	Ga	gallium 70	49	In	indium 115	81	11	thallium	204		
											30	Zn	zinc 65	48	Cd	cadmium 112	80	Hg	mercury	112	Cu	copernicium -
											29	Cu	copper 64	47	Ag	silver 108	79	Au	gold	19/	Rg	roentgenium -
Group											28	ïZ	nickel 59	46	Pd	palladium 106	78	۲ ۲	platinum	110	Ds	darmstadtium -
Gro					_						27	S	cobalt 59	45	Rh	rhodium 103	77	Ir	iridium	192	Mt	meitnerium -
		4	Т	hydrogen 1							26	Fе	iron 56	44	Ru	ruthenium 101	76	SO	osmium	190	Hs	hassium -
				-						25	Mn	manganese 55	43	ЦС	technetium -	75	Re	rhenium	180	Bh	bohrium —	
						bol	ass				24	ŗ	chromium 52	42	Mo	molybdenum 96	74	×	tungsten	184	Sq	seaborgium -
				Key	atomic number	atomic symbo	name relative atomic mass				23	>	vanadium 51	41	qN	niobium 93	73	Та	tantalum	181 105	Db	dubnium —
						ato	rels				22	F	titanium 48	40	Zr	zirconium 91	72	Ħ	hafnium	1/8	Ŗ	rutherfordium —
											21	Sc	scandium 45	39	≻	yttrium 89	57-71	lanthanoids		89-103	actinoids	
	II				4	Be	beryllium 9	12	Mg	magnesium 24	20	Ca	calcium 40	38	ي ا	strontium 88	56	Ba	barium	88	Ra	radium -
	-				ю	:	lithium 7	11	Na	sodium 23	19	¥	potassium 39	37	Rb	rubidium 85	55	Cs	caesium	87	л Ц	francium -

71 Lu Iutetium 175 103 Lr Iawrencium 70 Yby Ytterbium 173 102 102 NO mendelevium 69 101 Md 68 Er 167 100 100 fm fm 67 HO 165 99 ES 66 Dy dysprosium 163 98 Cf 65 Tb 159 97 97 berkelium 64 Gd 157 157 157 157 157 157 157 63 Eu <sup>europium</sup> 152 95 95 americium 62 Samarium 150 94 94 Pu 93 **Np** Teptunium oromethium Pm <sup>61</sup> eodymium 144 92 **U** uranium 238 <sup>00</sup> Nd praseodymium 141 91 Pa protactinium 231 **٦** 58 Cenium 140 90 90 HT 1232 57 La lanthanum 139 89 AC actinium lanthanoids actinoids

The volume of one mole of any gas is  $24\,dm^3$  at room temperature and pressure (r.t.p.).

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