Name: …….. ( ) Class: Sec 4 SG ……...

Queenstown Secondary School

Preliminary Examination 2024
Secondary Four Express
Science (Physics, Biology)
5087/01

28 August 2024 **Time: 0945 – 1045h**
Wednesday **Duration: 1 hour**

Setters:

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

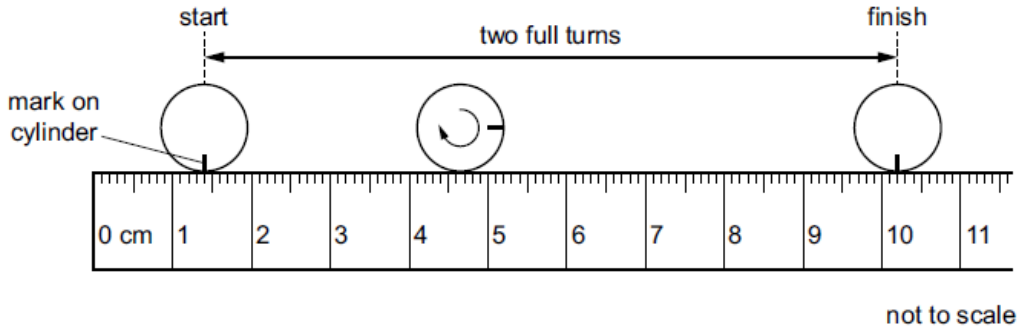
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided.

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.
The use of an approved scientific calculator is expected, where appropriate.

1 A small cylinder is rolled along a ruler and completes two full turns as shown in the diagram.



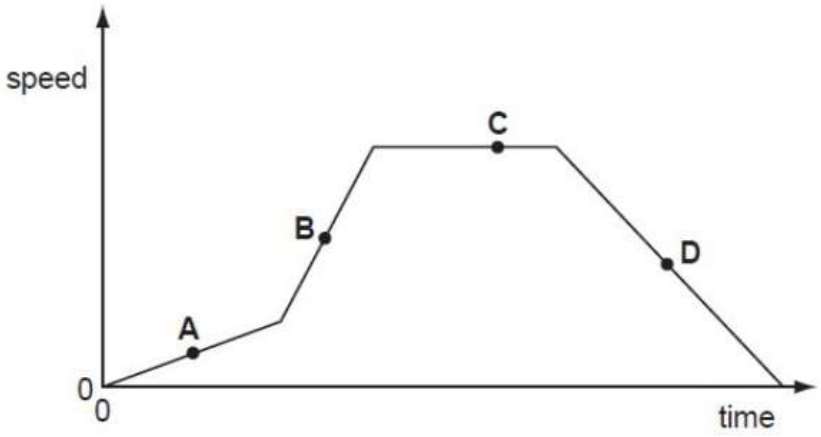
What is the circumference of the cylinder?

A 4.4 cm **B** 5.1 cm **C** 8.8 cm **D** 10.2 cm

2 A pendulum bob has a mass of 25 g. The period of the pendulum is 0.50 s.
If the mass of the pendulum bob is increased to 50 g, what is the new period?

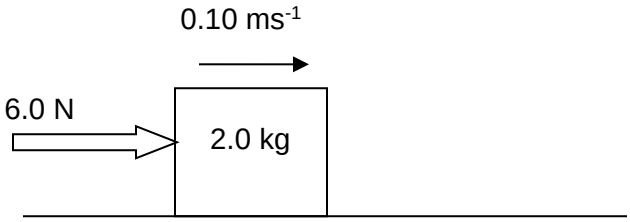
A 0.25 s **B** 0.50 s **C** 1.00 s **D** 2.00 s

3 The following speed-time graph shows the journey of a train.



At which point is the acceleration of the train the greatest in magnitude?

4 A box of mass 2.0 kg moves with a constant speed of 0.10 ms^{-1} when a force of 6.0 N is applied.



What is the frictional force and the resultant force acting on the box?

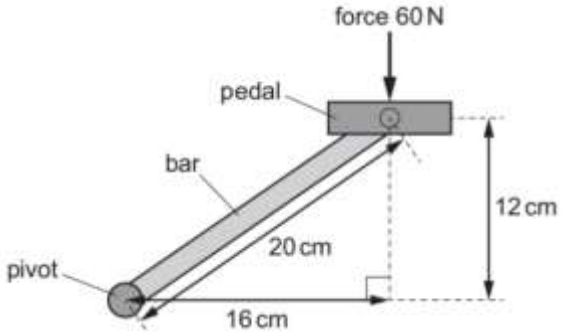
	frictional force	resultant force
A	0 N	6.0 N
B	3.0 N	0 N
C	5.8 N	0.2 N
D	6.0 N	0 N

5 A passenger is sitting in an aeroplane which takes off and climbs to 15 000 m in a certain time.

During this time what happens to the mass and to the weight of the passenger?

	mass	weight
A	decreases	decreases
B	increases	increases
C	unchanged	decreases
D	unchanged	increases

6 A bicycle pedal is connected to a pivot by a metal bar, as shown.



The force on the pedal is 60 N downwards.

What is the moment of this force about the pivot?

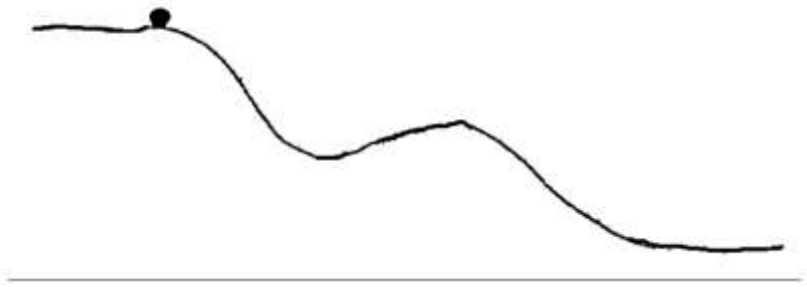
A 7.2 Nm **B** 9.6 Nm **C** 12 Nm **D** 1200 Nm

7 Which object, **A**, **B**, **C** or **D**, exerts the greatest pressure on the ground?

	weight / N	area of contact with ground / cm^2
A	30	100
B	600	200
C	750	3000
D	10 000	4000

8 A ball bearing of 0.5 g is placed at point X on a smooth track as shown. The ball moves from rest down the track and passes point Y which is 10 m below point X.

Take g = 10 m/s^2. X



What is the speed of the ball at point Y?

A 10.0 m/s **B** 14.1 m/s **C** 100 m/s **D** 141 m/s

9 A solid is heated but does not melt.

What happened to the molecules of the solid?

A Intermolecular bonds are broken.

B Molecules move about more vigorously about their fixed positions.

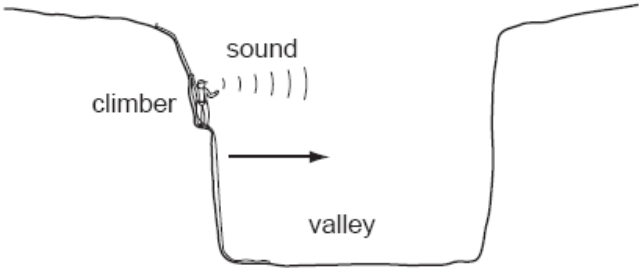
C Molecules move randomly with constant speed during this process.

D Molecules move randomly with increasing speed during this process.

10 To estimate the width of a valley, a climber starts a stopwatch as he shouts.

He hears an echo from the opposite side of the valley after 1.0 s.

The sound travels at 340 m/s.

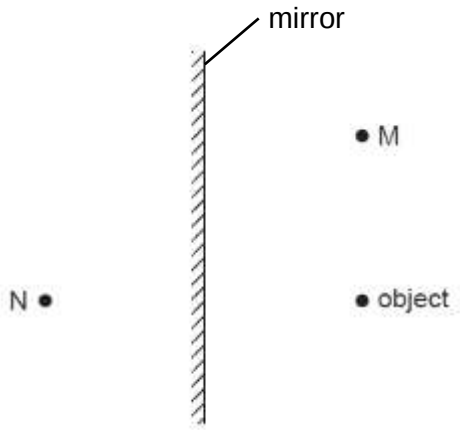


What is the width of the valley?

A 85 m **B** 170 m **C** 340 m **D** 680 m

11 The diagram shows an object in front of a plane mirror.

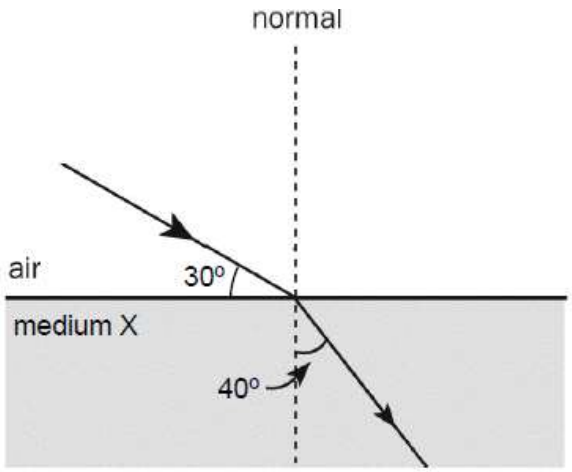
The mirror forms an image of the object.



At which labelled is the image formed, and which type of image is formed?

	where the image is formed	type of image
A	at M	real
B	at M	virtual
C	at N	real
D	at N	virtual

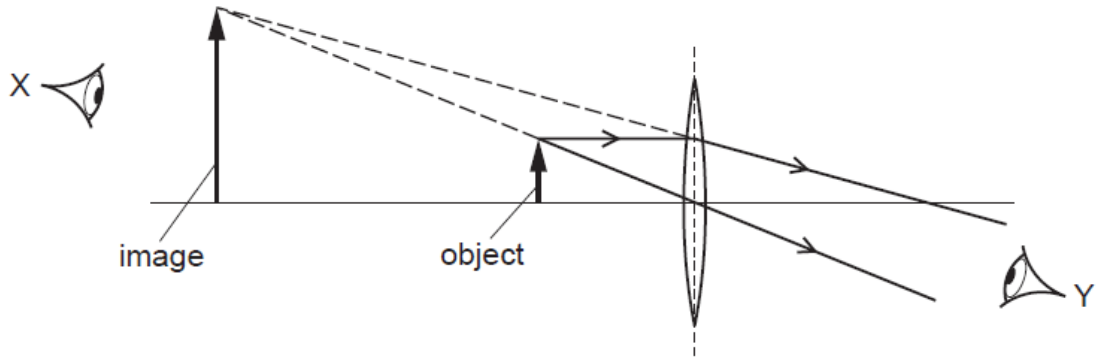
12 The diagram shows a light ray travelling from air into medium X.



What is the refractive index of medium X?

A 0.778 **B** 1.13 **C** 1.29 **D** 1.35

13 The diagram shows a converging lens forming an image of an object.



Which statement about the image is correct?

A It is real and can be seen by an eye at X.

B It is real and can be seen by an eye at Y.

C It is virtual and can be seen by an eye at X.

D It is virtual and can be seen by an eye at Y.

14 Below are four statements about the uses of the different components of the electromagnetic spectrum.

statement 1: Infra-red waves are used in television remote controllers.
statement 2: Radio waves are used to transmit television pictures from satellite to Earth.
statement 3: Ultraviolet waves are used for intruder alarms.
statement 4: X-rays are used for security checks.

Which statements are correct?

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

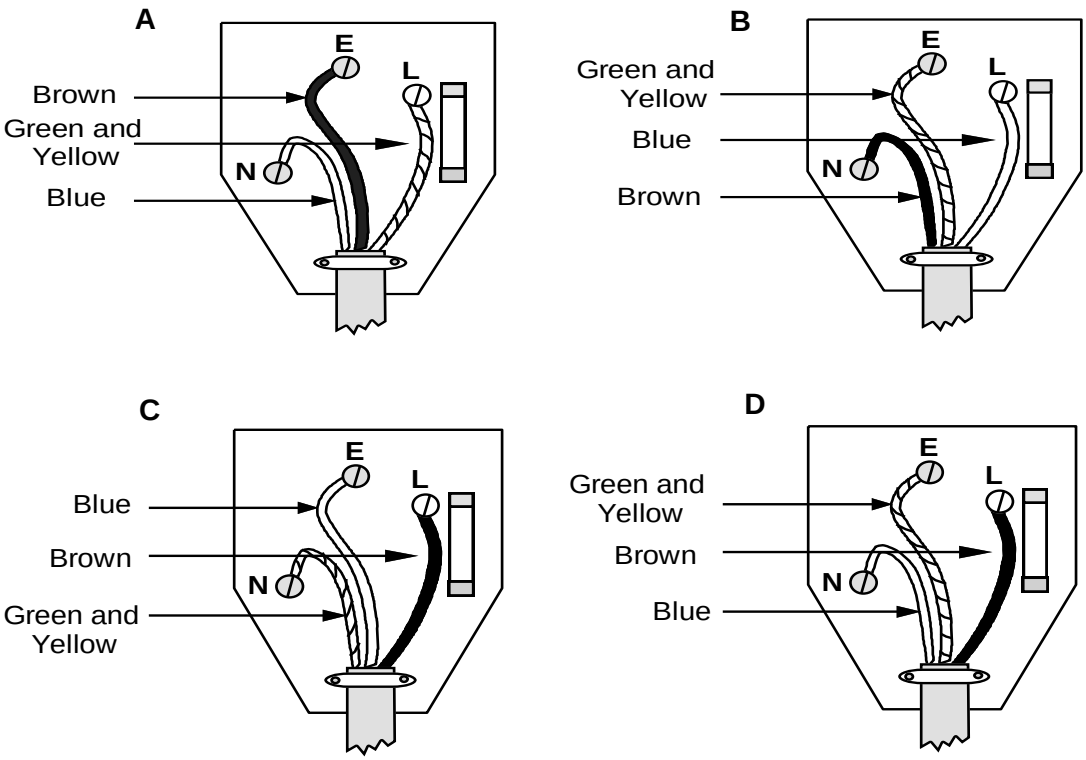
15 A wire of length of 1.0 m and cross-sectional area of 2 mm^2 has a resistance of 4.0 Ω. This wire is replaced by another similar wire of length 2.0 m and cross-sectional area of 4 mm^2.

What is the resistance of the second wire?

A 1.0 Ω **B** 4.0 Ω **C** 16 Ω **D** 18 Ω

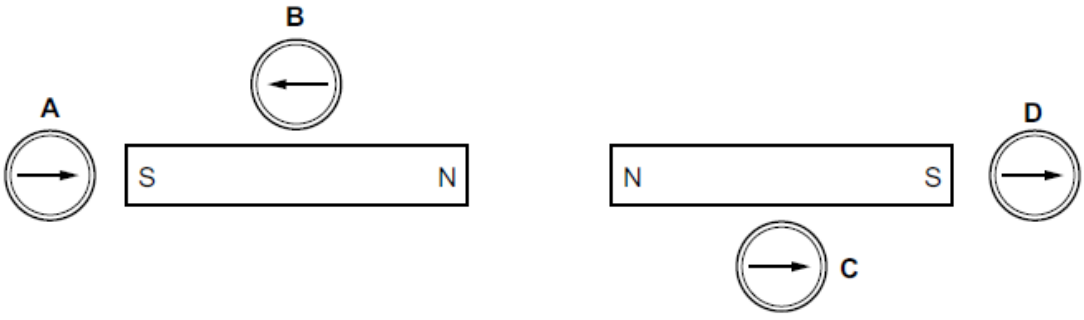
16 The diagrams show the inside of a three-pin plug.

Which one is correctly wired?



17 Four plotting compasses are placed in the magnetic field of two identical bar magnets as shown in the diagram.

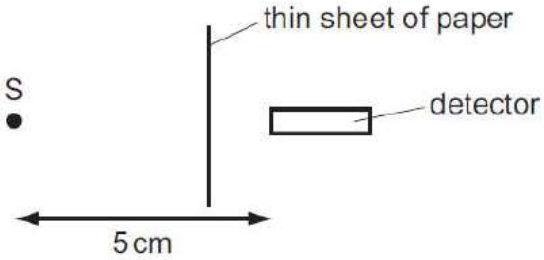
Which compass is shown pointing in the **wrong** direction?



18 Which material is commonly used as a lining for a box for storing radioactive samples?

A aluminium **B** copper **C** lead **D** uranium

19 S is a radioactive source emitting α-particles, β-particles, and γ-rays. A detector is placed 5 cm away from S. A thin sheet of paper is placed as shown in the diagram.



Which radiations can be detected?

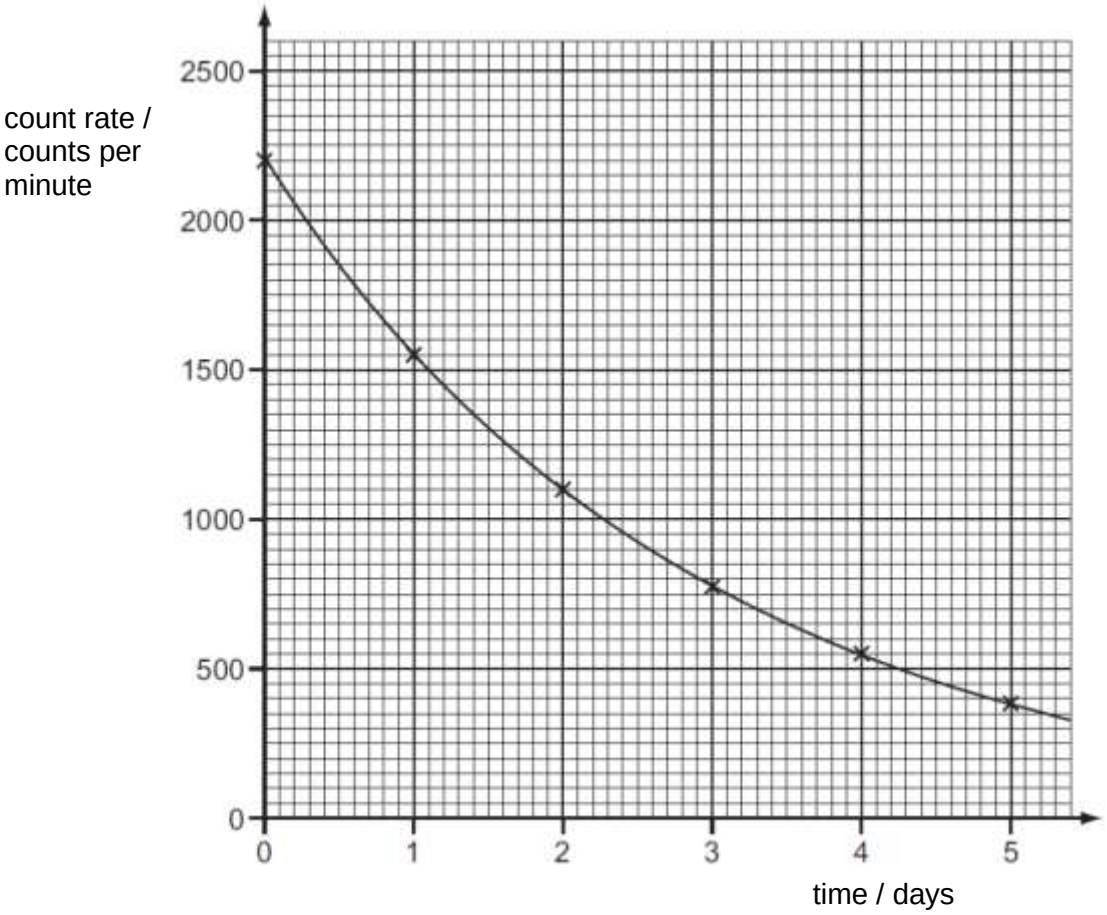
A α-particles and β-particles only

B α-particles and γ-rays only

C β-particles and γ-rays only

D α-particles, β-particles, and γ-rays

20 The graph shows the decay curve for a particular radioactive nuclide.

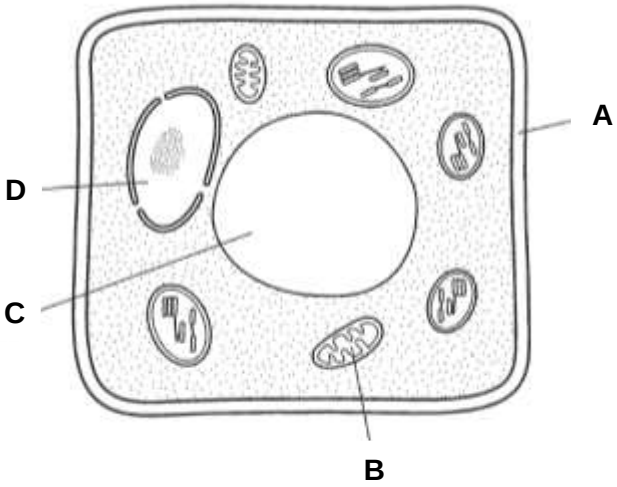


What is the half-life of this nuclide?

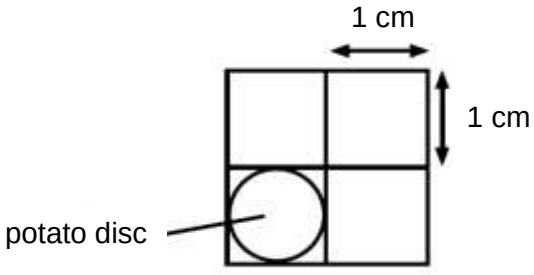
A 1.0 day **B** 1.5 days **C** 2.0 days **D** 2.5 days

21 The diagram shows a plant cell.

Which labelled structure produces carbon dioxide?



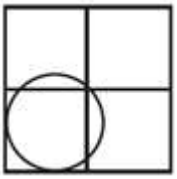
22 The diagram below shows the initial diameter of a potato disc.



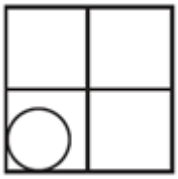
The potato disc was placed in a solution of high water potential for one hour.

Which of the following diagrams shows correctly the change in the diameter of the potato disc?

A

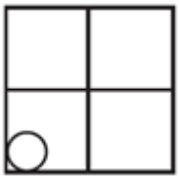


B



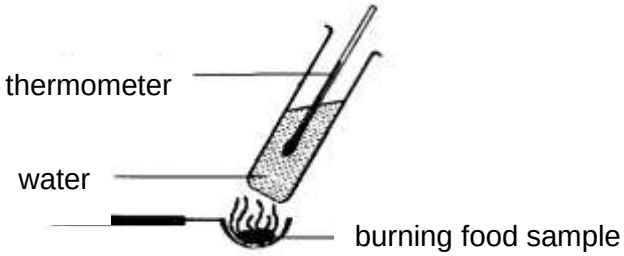
C

D



23 Four equal masses of different foods were burned as shown below. The temperature of the water was measured before and after each experiment and recorded as shown.

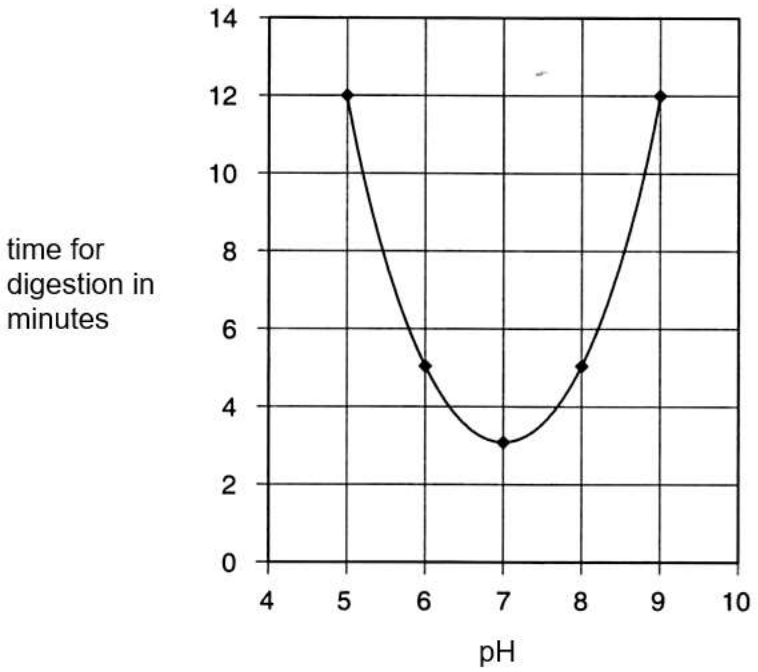
Which food sample probably contains (i) the most, and (ii) the least amount of fat?



food sample	water temperature at start /ºC	water temperature at end /ºC
P	18	50
Q	16	80
R	19	35
S	18	97

	(i)	(ii)
A	Q	R
B	R	S
C	Q	P
D	S	R

24 A student investigates the effect of pH change on the activity of an enzyme. He measures the time taken for digestion to complete at different pH values. His results are shown in the figure below.



Which of the following is the most appropriate inference of the results?

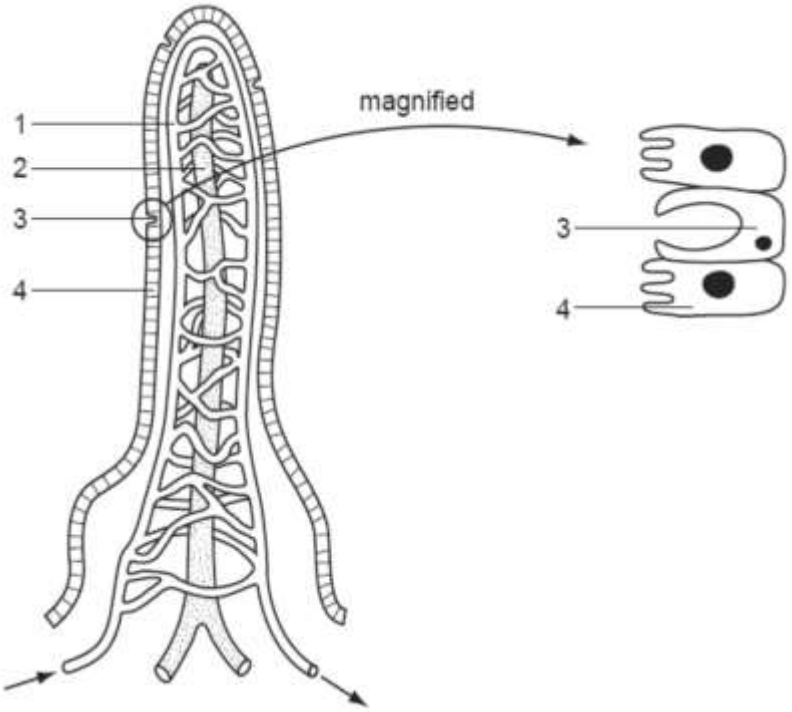
A the enzyme is active at both acidic and alkaline pH

B the enzyme is inactive in acidic pH

C the enzyme is more active at higher pH

D the enzyme needs neutral pH to work.

25 The diagram shows a section through a villus.

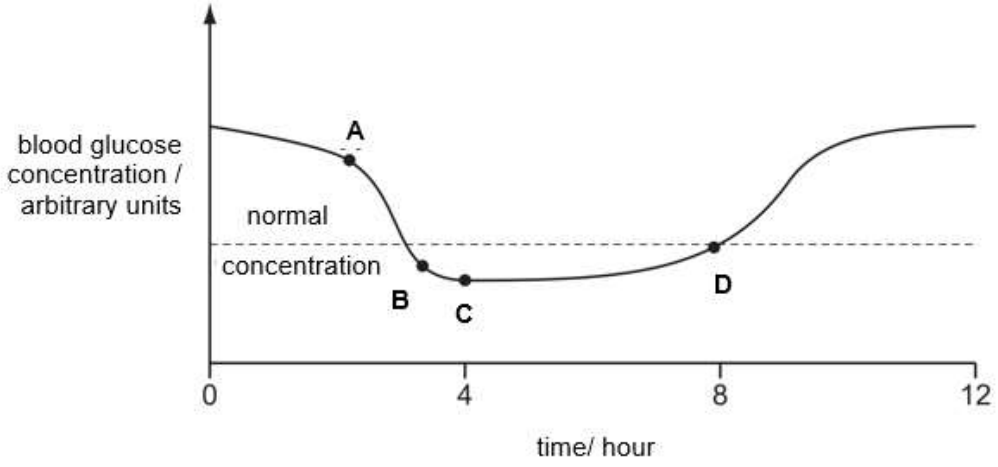


Which sequence correctly describes the functions of the numbered parts?

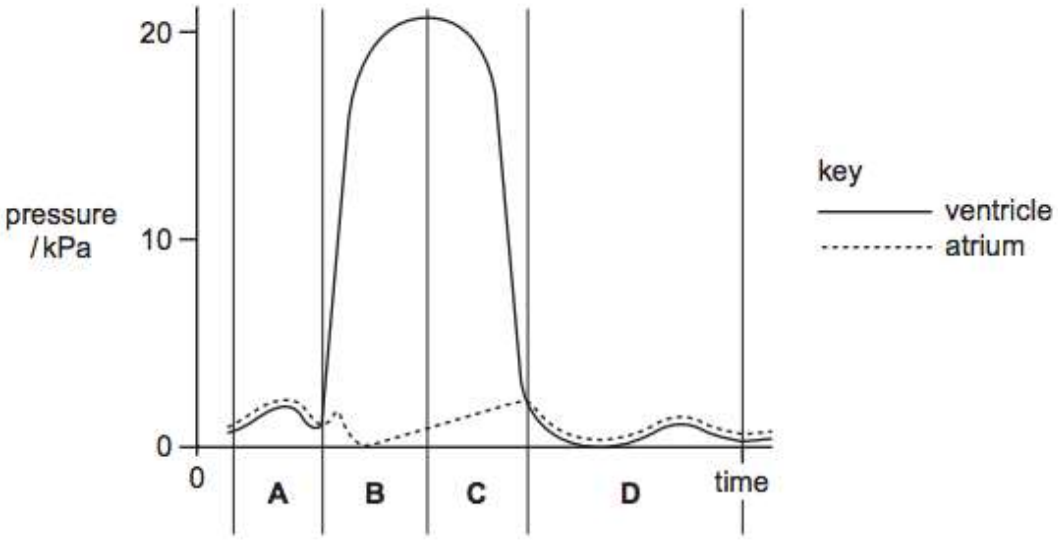
	1	2	3	4
A	transports digested fats	transports glucose	absorbs digested food	produces mucus
B	transports digested fats	transports glucose	produces mucus	absorbs digested food
C	transports glucose	transports digested fats	absorbs digested food	produces mucus
D	transports glucose	transports digested fats	produces mucus	absorbs digested food

26 A patient who suffers from diabetes mellitus receives treatment with insulin injections. The graph shows how the patient's blood glucose concentration changed during part of one day.

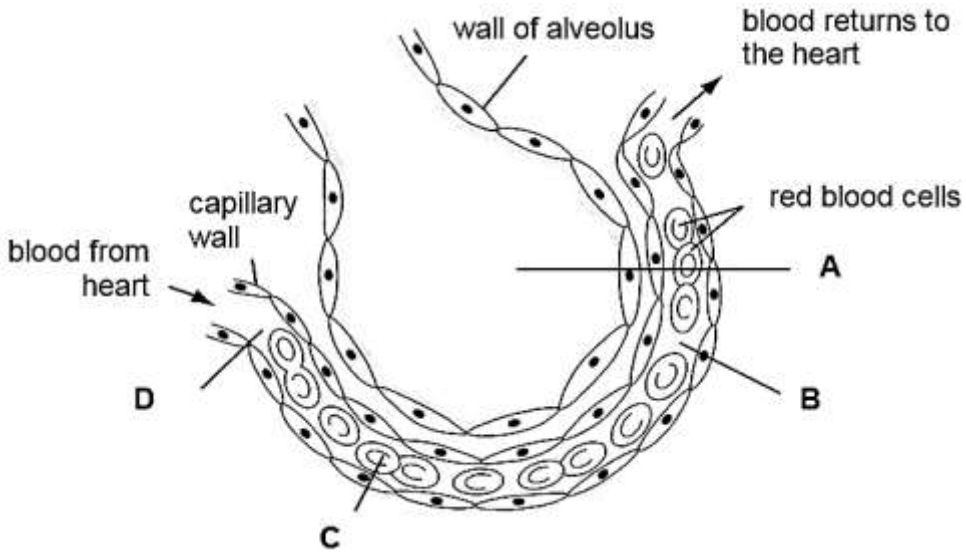
At which point was an insulin injection administered?



27 The diagram below shows the changes in blood pressure in the left ventricle of the heart. During which period is the left ventricle contracting?



28 The diagram below shows a section of an alveolus and a capillary in the lung.
In which part is the concentration of dissolved carbon dioxide the lowest?



29 Which substance is produced in both aerobic respiration in humans and anaerobic respiration in yeast?

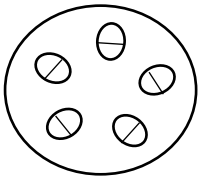
A glucose **B** carbon dioxide **C** ethanol **D** water

30 Antibiotics are used to treat some infection.
How does antibiotics work?

A by binding to bacteria
B by killing or inhibiting the growth of bacteria
C by producing more white blood cells
D by stimulating the production of antibodies.

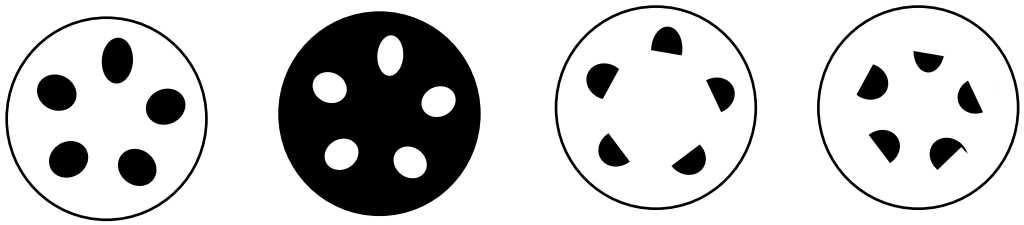
31 The leaves of a plant were exposed to carbon dioxide containing radioactive carbon for two hours in the sunlight. A cross-section of the plant's stem was then immediately obtained and placed on an X-ray film that blackens when exposed to radioactivity to produce an autoradiograph.

The following diagram shows a cross-section of the stem.

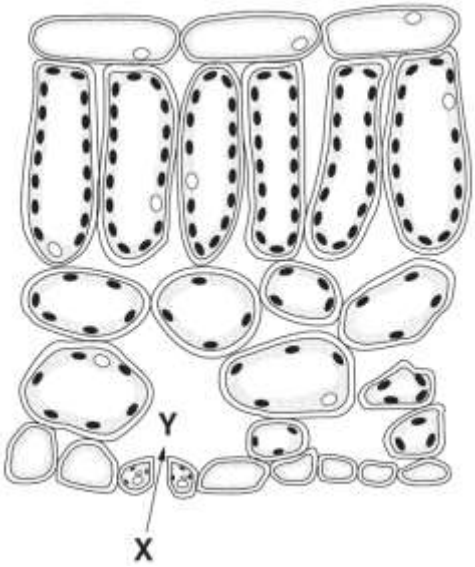


Which of the following shows the result of the autoradiograph?

A **B** **C** **D**



32 The diagram shows a section through a leaf.

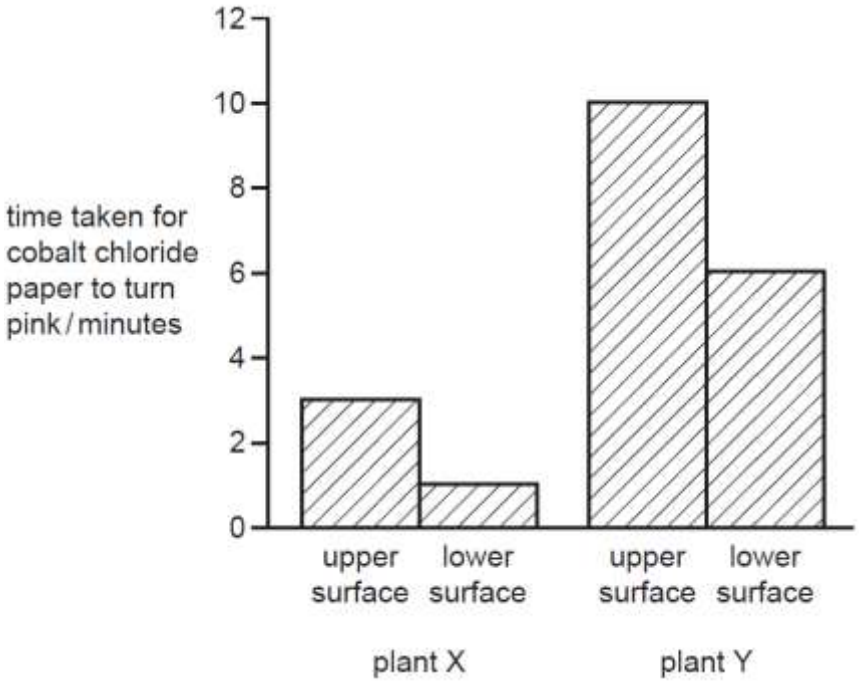


By which process does carbon dioxide pass from X to Y?

A diffusion **B** osmosis **C** translocation **D** transpiration

33 Cobalt chloride paper is blue when dry but turns pink when wet. Some blue cobalt chloride paper was fastened to the upper and lower surfaces of a leaf on plant X and a leaf on plant Y.

The diagram shows the results of the experiment.



Through which leaf surface was water lost most slowly?

A plant X, upper surface

B plant X, lower surface

C plant Y, upper surface

D plant Y, lower surface

34 What is an advantage of a short food chain?

A A few producers can support a large number of consumers.

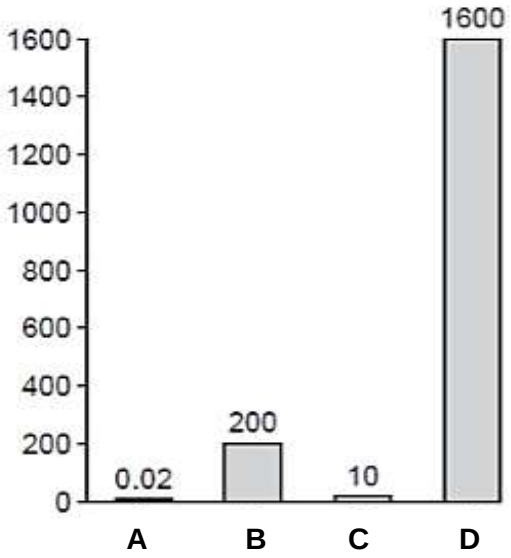
B It is easier for consumers to find food.

C Less energy is lost in the food chain.

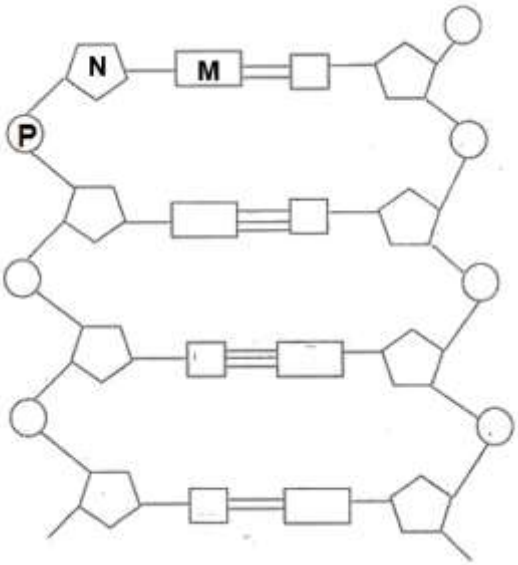
D Less food is required by the consumers.

35 The graph shows the quantities of pesticide that accumulate in four populations, **A**, **B**, **C** and **D**, each at different trophic levels in a food chain.

Which population is most likely to be herbivores?



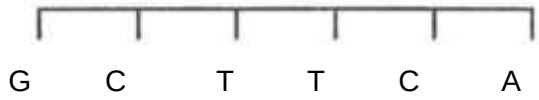
36 The diagram shows structure of a segment of a DNA.



Which of the following are correct labels for M, N and P?

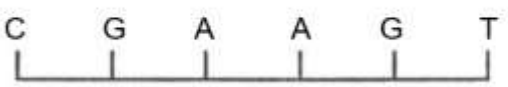
	M	N	P
A	nitrogenous base	deoxyribose sugar	phosphate group
B	nitrogenous base	phosphate group	deoxyribose sugar
C	deoxyribose sugar	nitrogenous base	phosphate group
D	phosphate group	deoxyribose sugar	nitrogenous base

37 The diagram shows a sequence of bases along a single strand of DNA.

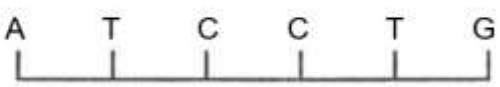


Which diagram shows the sequence of bases in the complementary strand?

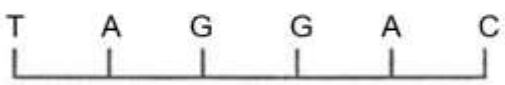
A



B

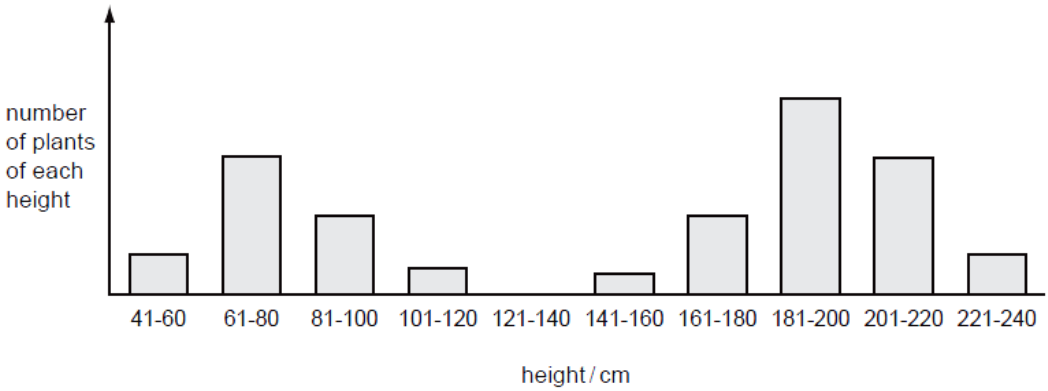


C



D

38 The heights of 500 pea plants of the same age were measured to the nearest 20 cm. The results are shown in the chart below.



What does the variation in height of these pea plants show?

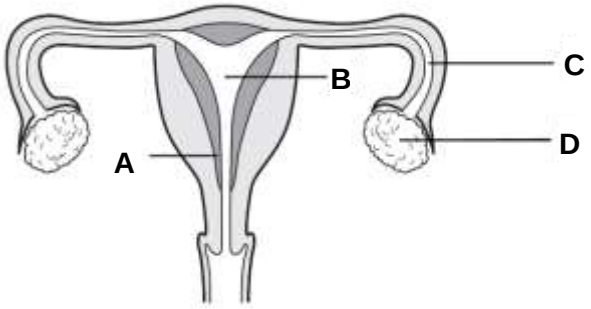
A continuous variation only

B discontinuous variation only

C both continuous and discontinuous variation

D neither continuous nor discontinuous variation

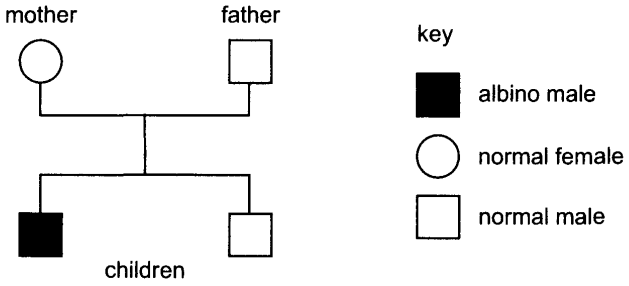
39 The diagram shows the female reproductive system.



In which part is the zygote formed?

40 In humans the allele for albinism is recessive.

The diagram shows the inheritance of albinism in a family.



What are the genotypes of the parents?

	mother	father
A	heterozygous	heterozygous
B	heterozygous	homozygous dominant
C	homozygous recessive	homozygous dominant
D	homozygous recessive	homozygous recessive

DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							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

proton (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.)

[Turn over

MARK SCHEME

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21	B
22	D
23	C
24	C
25	D
26	A
27	C
28	C
29	B
30	B

31	C
32	D
33	B
34	D
35	B
36	A
37	D
38	C
39	B
40	B