

Name:



OUNDLE

School

2020 Non Common Entrance Examination
For Third and Fourth Form Entry

Science

Time Allowed : 60 minutes

- *Please write your name in the box above*
- *Answer as many questions as you can in the time available*
- *The paper is out of 78 marks; 30 for Biology, 24 for Chemistry and 24 for Physics*

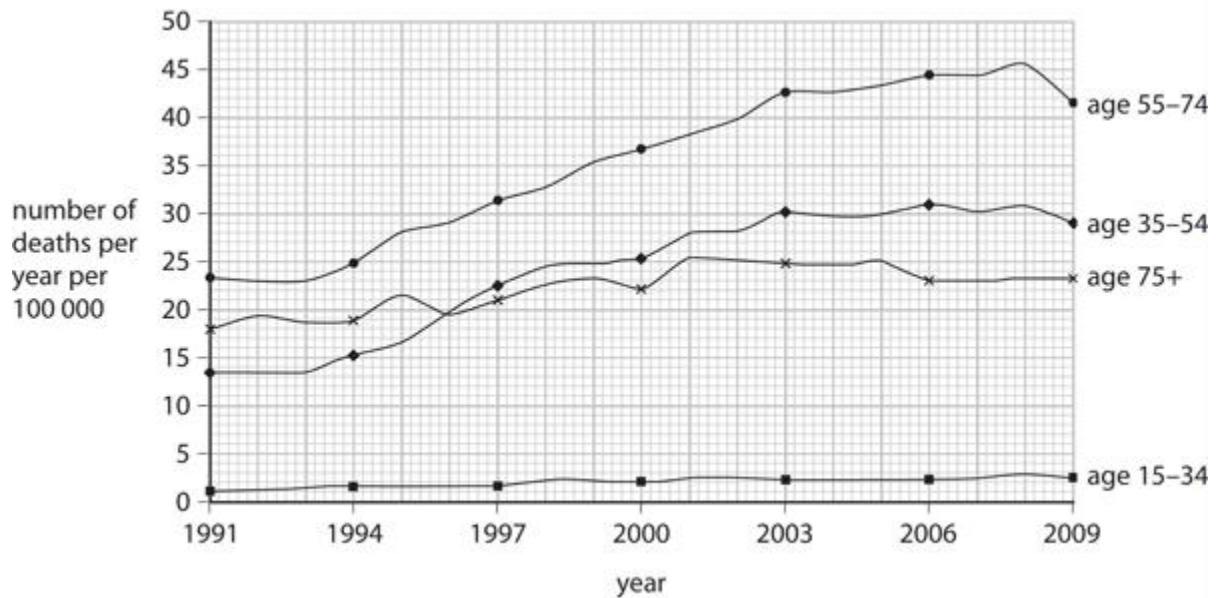
You will need:

- *A pen*
- *A pencil*
- *A ruler*
- *A calculator*

Biology mark / 30	
Chemistry mark / 24	
Physics mark / 24	
Total mark / 78	
Percentage	

Biology Written Answer Section

1. The graph shows the number of alcohol-related deaths in Britain in four age ranges.



a. Which age range has the highest number of alcohol-related deaths in Britain?
Put a cross (X) in the box next to your answer.

A	15 to 34	<input type="checkbox"/>
B	35 to 54	<input type="checkbox"/>
C	55 to 74	<input type="checkbox"/>
D	75+	<input type="checkbox"/>

(1)

b. Describe the trend shown for alcohol-related deaths in the age range 35–54 years.

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.....

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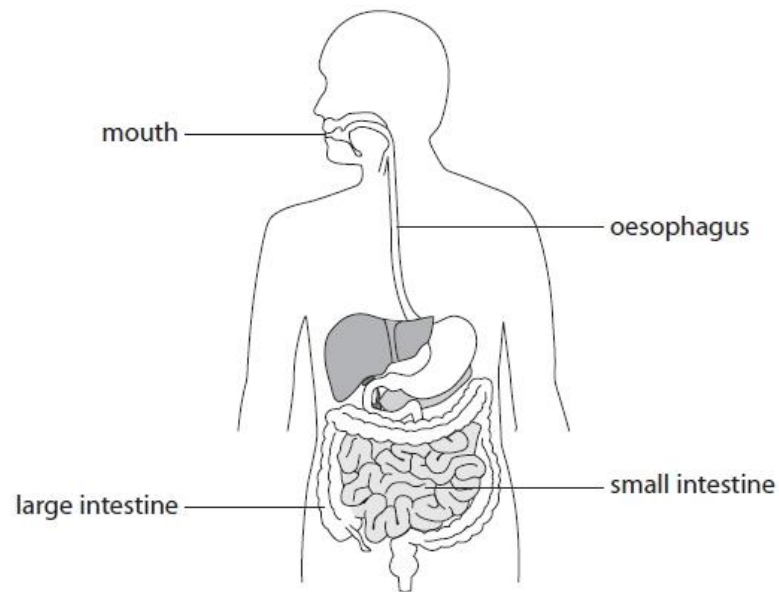
(2)

c. Suggest **one** reason for the reduction in alcohol-related deaths between 2008 and 2009 for 55–74 year olds.

.....
.....
(1)

(Total 4 marks)

2. The diagram shows the digestive system of a human.



a. Describe the role of the mouth in digestion.




.....
.....
.....
.....
(2)

b. Villi are structures in the small intestine.
i. Which **one** of the statements about villi is true?
Place a cross (X) in the box next to your answer.

- A** glucose is the only substance absorbed by villi
 - B** three types of enzyme are absorbed by villi
 - C** the capillary network in the villi have a large surface area
 - D** the walls of the villi are thicker to absorb more food
- | |
|--|
| |
| |
| |
| |

(1)

- ii. Coeliac disease can cause a loss of microvilli.
The table shows how the structure of villi affects the surface area of the small intestine.

structure	diagram	surface area compared to small intestine as a tube
small intestine as a tube with no villi or microvilli		1
small intestine with villi but no microvilli		30
small intestine with villi and microvilli		600

A person with coeliac disease has no microvilli in their small intestine.
Explain why this person would find it hard to exercise.
Use information from the table to help you.

.....

.....

.....

.....

(3)

- c. Fibre in food is not digested.
Fibre makes up most of the solid material in the contents of the small intestine.
The recommended daily allowance (RDA) for fibre is between 18g and 30g.
Suggest why the muscles in the intestines of someone who eats much less fibre per day than the RDA may have trouble moving food through the small intestine.

.....

.....

(2)

(Total 8 marks)

3. The photograph shows a bee collecting nectar from a flower.



a. Nectar is made from glucose produced by plants.
Name the process that plants use to make glucose.

.....
(1)

b. When the bee collects nectar from the flower, the plant benefits because the pollen sticks to the bee and is carried to another flower.

i. Complete the sentence by putting a cross (X) in the box next to your answer.
The relationship between the bee and the plant is an example of...

A	decomposing	<input type="checkbox"/>
B	eutrophication	<input type="checkbox"/>
C	mutualism	<input type="checkbox"/>
D	parasitism	<input type="checkbox"/>

(1)

- ii. Some bees have evolved a new method of collecting nectar from flowers. They drill a small hole in the base of the flower and collect the nectar through the hole. This means the pollen does not stick to the bee. Suggest why this is an advantage to the bees.

.....
.....
(2)

- c. Bees can sting people. State the physical barrier of the human body that would have to be broken by the bee sting.

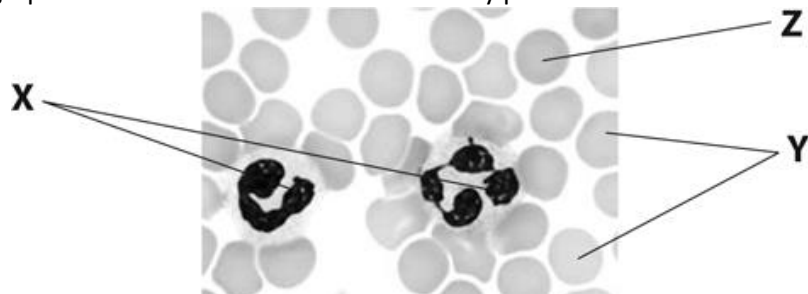
.....
(1)

- d. Honey produced by bees is a natural antiseptic. Describe how antiseptics can be used, during food preparation, to prevent the spread of infections.

.....
.....
(2)

(Total 7 marks)

4. The photograph shows a blood smear from a healthy person.



- i. Name the two types of blood cells, X and Y, shown in the photograph.

.....
.....
(2)

- ii. Complete the sentence by putting a cross (X) in the box next to your answer.
The function of the cells labelled X is to

A	engulf bacteria	<input type="checkbox"/>
B	produce antigen	<input type="checkbox"/>
C	transport carbon dioxide	<input type="checkbox"/>
D	transport oxygen	<input type="checkbox"/>

(1)

- iii. Measure the diameter of the cell labelled Z.

diameter = mm
(1)

- iv. The cell labelled Z is magnified $\times 900$.
Calculate the actual diameter of the cell labelled Z.

actual diameter = μm
(2)

(Total 6 marks)

Biology Multiple Choice Section

In this section Complete the sentence by putting a cross (X) in the box next to your answer.

5. Chemicals may prevent the entry of pathogens. One chemical that prevents the entry of pathogens is...

A	cilia	<input type="checkbox"/>
B	lysozyme	<input type="checkbox"/>
C	mucus	<input type="checkbox"/>
D	skin	<input type="checkbox"/>

(Total 1 mark)

6. Food is moved through the digestive system by...

A	diffusion	<input type="checkbox"/>
B	digestion	<input type="checkbox"/>
C	peristalsis	<input type="checkbox"/>
D	active transport	<input type="checkbox"/>

(Total 1 mark)

7. Plants lose water, into the air, by a process called...

- | | | |
|----------|------------------|--------------------------|
| A | active transport | <input type="checkbox"/> |
| B | fertilisation | <input type="checkbox"/> |
| C | photosynthesis | <input type="checkbox"/> |
| D | transpiration | <input type="checkbox"/> |

(Total 1 mark)

8. Cigarette smoke contains many substances that can have harmful effects on the human body. The addictive substance in cigarette smoke is...

- | | | |
|----------|-----------------|--------------------------|
| A | arsenic | <input type="checkbox"/> |
| B | carbon monoxide | <input type="checkbox"/> |
| C | nicotine | <input type="checkbox"/> |
| D | tar | <input type="checkbox"/> |

(1)

a. Some of the chemicals in cigarette smoke are carcinogens. Define the word carcinogen.

.....

.....

(1)

(Total 2 marks)

Total for Biology Section = 30 marks

Chemistry Written Answer Section

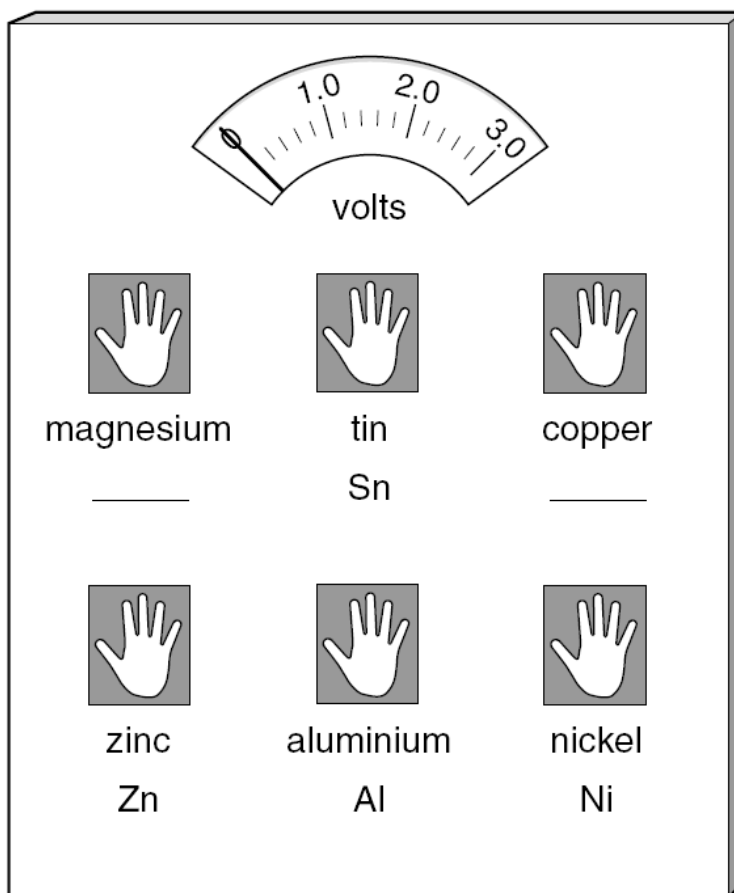
		1		2		3		4		5		6		7		8 or 0																																															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17																																													
1	H hydrogen	7	Li lithium	9	Be beryllium	11	B boron	12	C carbon	14	N nitrogen	16	O oxygen	19	F fluorine	20	Ne neon																																														
3	Na sodium	3	Li lithium	4	Be beryllium	5	B boron	6	C carbon	7	N nitrogen	8	O oxygen	9	F fluorine	10	Ne neon																																														
23	Na sodium	24	Mg magnesium	25	Al aluminium	27	Al aluminium	28	Si silicon	31	P phosphorus	32	S sulphur	35.5	Cl chlorine	40	Ar argon																																														
11	K potassium	12	Ca calcium	13	Sc scandium	14	Ti titanium	15	V vanadium	16	Cr chromium	17	Mn manganese	18	Fe iron	19	Co cobalt	20	Ni nickel	21	Cu copper	22	Zn zinc	23	Ga gallium	24	Ge germanium	25	As arsenic	26	Se selenium	27	Br bromine	28	Kr krypton																												
39	K potassium	40	Ca calcium	41	Sc scandium	42	Ti titanium	43	V vanadium	44	Cr chromium	45	Mn manganese	46	Fe iron	47	Co cobalt	48	Ni nickel	49	Cu copper	50	Zn zinc	51	Ga gallium	52	Ge germanium	53	As arsenic	54	Se selenium	55	Br bromine	56	Kr krypton																												
86	Rb rubidium	87	Sr strontium	88	Y yttrium	89	Zr zirconium	90	Nb niobium	91	Mb molybdenum	92	Tc technetium	93	Ru ruthenium	94	Rh rhodium	95	Pd palladium	96	Ag silver	97	Cd cadmium	98	In indium	99	Sn tin	100	Sb antimony	101	Te tellurium	102	I iodine	103	Xe xenon																												
37	Rb rubidium	38	Sr strontium	39	Y yttrium	40	Zr zirconium	41	Nb niobium	42	Mb molybdenum	43	Tc technetium	44	Ru ruthenium	45	Rh rhodium	46	Pd palladium	47	Ag silver	48	Cd cadmium	49	In indium	50	Sn tin	51	Sb antimony	52	Te tellurium	53	I iodine	54	Xe xenon																												
133	Cs caesium	137	Ba barium	138	Lr lawrencium	139	Hf hafnium	140	Ta tantalum	141	W tungsten	142	Re rhenium	143	Os osmium	144	Ir iridium	145	Pt platinum	146	Au gold	147	Hg mercury	148	Tl thallium	149	Pb lead	150	Bi bismuth	151	Po polonium	152	At astatine	153	Rn radon																												
55	Cs caesium	56	Ba barium	57	La lanthanum	58	Ce cerium	59	Pr praseodymium	60	Nd neodymium	61	Pm promethium	62	Sm samarium	63	Eu europium	64	Gd gadolinium	65	Tb terbium	66	Dy dysprosium	67	Ho holmium	68	Er erbium	69	Tm thulium	70	Yb ytterbium	71	Lu lutetium	72	Hf hafnium	73	Ta tantalum	74	W tungsten	75	Re rhenium	76	Os osmium	77	Ir iridium	78	Pt platinum	79	Au gold	80	Hg mercury	81	Tl thallium	82	Pb lead	83	Bi bismuth	84	Po polonium	85	At astatine	86	Rn radon
(223)	Fr francium	(226)	Ra radium	(261)	Rf rutherfordium	(262)	Sg seaborgium	(263)	Bh bohrium	(264)	Hs hassium	(265)	Mt meitnerium	(266)	Ds darmstadtium	(267)	Rg roentgenium	(268)	Uu unbinidum	(269)	Uub unbihadium	(270)	Uuq unquadium	(271)	Uuq unquadium	(272)	Uub unbihadium	(273)	Uuq unquadium	(274)	Uub unbihadium	(275)	Uuq unquadium	(276)	Uub unbihadium	(277)	Uuq unquadium	(278)	Uub unbihadium	(279)	Uuq unquadium	(280)	Uub unbihadium	(281)	Uuq unquadium	(282)	Uub unbihadium																
(223)	Fr francium	(226)	Ra radium	(261)	Rf rutherfordium	(262)	Sg seaborgium	(263)	Bh bohrium	(264)	Hs hassium	(265)	Mt meitnerium	(266)	Ds darmstadtium	(267)	Rg roentgenium	(268)	Uu unbinidum	(269)	Uub unbihadium	(270)	Uuq unquadium	(271)	Uuq unquadium	(272)	Uub unbihadium	(273)	Uuq unquadium	(274)	Uub unbihadium	(275)	Uuq unquadium	(276)	Uub unbihadium	(277)	Uuq unquadium	(278)	Uub unbihadium	(279)	Uuq unquadium	(280)	Uub unbihadium																				

mass number, A
 symbol
 name
 atomic number, Z

H
hydrogen

e.g. (99) mass numbers in brackets correspond to the most stable isotope of radioactive elements

9. The diagram shows an exhibit at a science museum. It has six blocks of metal connected to a voltmeter.
- a. Write the chemical symbols for magnesium and copper in the appropriate spaces in the diagram below.



(1)

- b. When visitors place their hands on two blocks of metal at the same time, the voltmeter registers a change in the voltage. Some examples are shown in the table.

Hands placed on	Reading on voltmeter (volts)
magnesium & tin	2.1
magnesium & copper	2.5
magnesium & zinc	1.5
magnesium & aluminium	0.6
magnesium & nickel	2.0

The reading on the voltmeter depends on the reactivity of the two metals touched.
The bigger the difference in reactivity, the higher the reading on the voltmeter.

i. Magnesium is the most reactive of these metals. Which metal is the least reactive?

.....
(1)

ii. If two blocks of magnesium were used in the experiment, instead of two different metals, what would the voltmeter read?

.....volts
(1)

Explain your answer.

.....
.....
(1)

iii. Look at the voltmeter readings in the table opposite.
On which two metals, other than magnesium, would a person put their hands to give the lowest reading on the voltmeter?

..... and
(1)

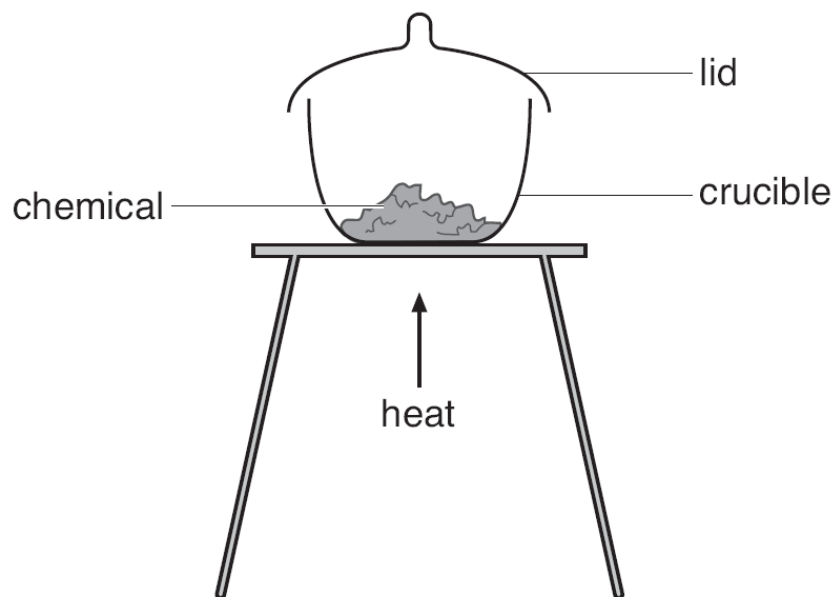
iv. Sodium is a more reactive metal than magnesium.
Suggest a reason why the exhibit did not include a plate of sodium for visitors to touch.

.....
(1)

(Total 6 marks)

10. Harry investigated differences between physical and chemical changes.

- He put three chemicals in separate crucibles and weighed each one.
- He heated each crucible as shown below.
- He weighed each crucible again when it had cooled down.



Harry recorded his observations in a table as shown below.

Experiment	Name of chemical	Observations	Change in mass
A	magnesium (a silvery solid)	The silvery magnesium burned brightly in air. A white powder was formed.	Increase
B	potassium permanganate (purple crystals)	The purple crystals crackled and turned black. A colourless gas was given off.	Decrease
C	zinc oxide (a white powder)	The white powder turned pale yellow on heating. It turned white again on cooling.	No change

a. In experiment A, magnesium reacts with a gas in the air.

i. Complete the word equation for the reaction in experiment A.

magnesium + → (1)

ii. Explain the increase in mass in experiment A. Use your word equation to help you.

.....
 (1)

- b. The gas given off in experiment B re-lit a glowing splint.
Give the name of the gas.

.....
(1)

- c. Experiment B is an example of what type of reaction? Circle one of the possibilities below to show your answer.

neutralization precipitation thermal decomposition

(1)

- d. Name the white powder that was left at the end of experiment C.

.....
(1)

- e. Using the table below for your answers, indicate whether a chemical change or a physical change took place in each experiment.
Tick one box for each experiment.

Experiment	Chemical Change	Physical Change
A		
B		
C		

(3)

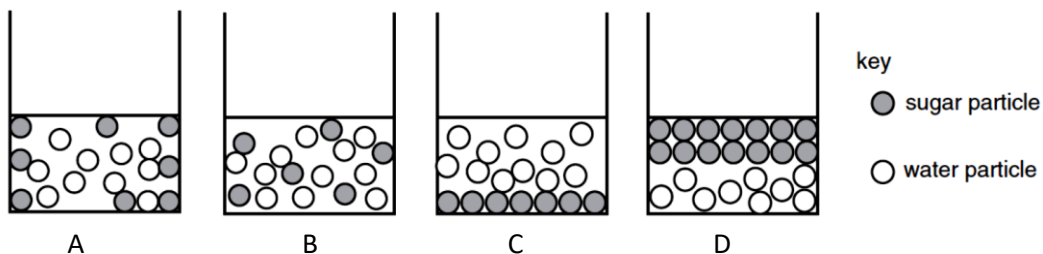
(Total 8 marks)

Chemistry Multiple Choice Section

For each of the questions in this section, circle the letter that corresponds to the correct answer.

11. Some sugar is dissolved in water.

Which diagram shows how the particles are arranged in the solution?



(Total 1 mark)

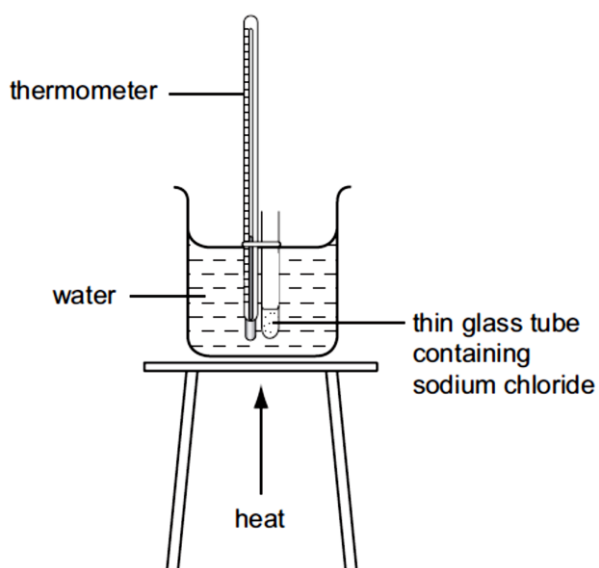
12. Heating a liquid causes it to become a gas.

What happens to the molecules of the liquid during this process?

	The molecules become bigger	The molecules move further apart
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

(Total 1 mark)

13. The apparatus shown cannot be used to determine the melting point of sodium chloride, NaCl.



Why is this?

	The melting point of NaCl is above 100°C	NaCl dissolves in the water
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

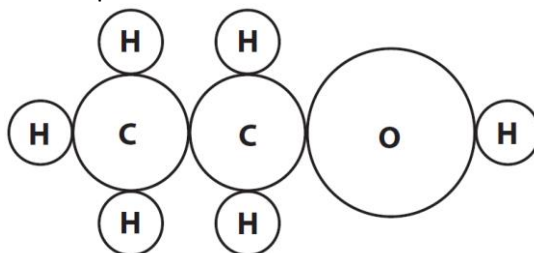
(Total 1 mark)

14. The melting points and boiling points of four substances are shown below. Which substance is liquid at 100°C?

substance	melting point /°C	boiling point /°C
A	-203	-17
B	-25	50
C	11	181
D	463	972

(Total 1 mark)

15. The diagram shows the atoms present in a molecule of ethanol.



Which number of elements and number of atoms is correct for a molecule of ethanol?

	Number of elements	Number of atoms
A	1	1
B	3	9
C	9	3
D	9	9

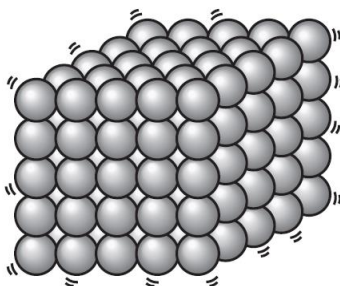
(Total 1 mark)

16. Which of the following is made up of only one type of atom?

- A a piece of aluminium foil
- B a crystal of sugar
- C a drop of water
- D a piece of wood

(Total 1 mark)

17. The picture below shows the particle model for a substance.



Which substance does this particle model best represent?

- A carbon dioxide gas
- B liquid water
- C solid iron
- D chlorine gas

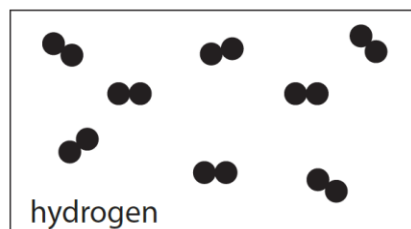
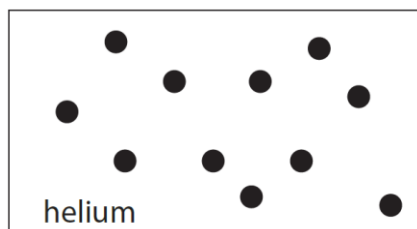
(Total 1 mark)

18. Which of these is an example of a chemical reaction?

- A melting candle wax
- B adding sodium chloride to water
- C add magnesium to acid
- D freezing water to make an ice cube

(Total 1 mark)

19. These diagrams represent the gases helium and hydrogen.



- A Helium gas exists as atoms and hydrogen gas exists as molecules.
- B Helium gas and hydrogen gas both exist as molecules.
- C Helium gas and hydrogen gas both exist as atoms.
- D Helium gas exists as molecules and hydrogen gas exists as atoms.

(Total 1 mark)

20. What is the shaded part of the Periodic Table showing?

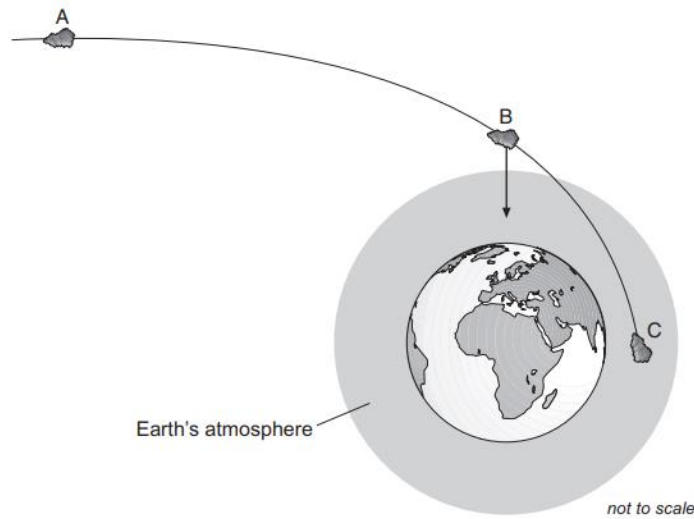
																1 H hydrogen 1																	4 He helium 2
7 Li lithium 3		9 Be beryllium 4																		11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10								
23 Na sodium 11		24 Mg magnesium 12																		27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18								
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36																
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54																
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86																
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated																						

- A gases
- B a group
- C metals
- D a period

(Total 1 mark)

Physics Written Answer Section

21. The diagram below shows the path of a meteor as it gets closer to the Earth. The meteor is shown in three positions: A, B and C.



- a. The path of the meteor is affected by the Earth's gravity. The arrow shows the direction of the force due to gravity acting on the meteor at B.
- i. On the diagram draw an arrow to show the direction of the force of gravity on the meteor at A. Use a ruler. **(1)**
- ii. On the diagram draw an arrow to show the direction of the force of gravity on the meteor at C. Use a ruler. **(1)**

- iii. How does the force of gravity on the meteor change as it travels from A to C?

.....

.....

(1)

- b. What happens to the speed of the meteor as it travels from A to B?

.....

.....

(1)

- c. When the meteor enters the Earth's atmosphere, three forces act on the meteor. Gravity and upthrust are two of these forces. Give the name of the other force.

.....

(1)

(Total 5 marks)

22.

a. Describe briefly how the amplitude of a sound wave affects the sound that we hear.

.....
.....
(1)

b. Describe briefly how the frequency of a sound wave affects the sound that we hear.

.....
.....
(1)

The table below explains how the properties of sound and light can be compared, despite their fundamental differences.

Property of Sound	Equivalent Property of light
Loudness	Brightness
Pitch	Colour

Two wave speeds are given below. One is the approximate speed of sound in air; the other is the approximate speed of light in air.

Speed A = 300 000km/s

Speed B = 0.3 km/s

c. Light and sound travel at very different speeds. Briefly describe one example from everyday life in which this fact is apparent.

.....
.....
.....
(1)

Stars are luminous objects; we can see them from Earth because they emit light. The table below compares the properties of different types of star.

Star Colour/Type	Relative Brightness*
Blue Giant	1
Red Giant	2
'Normal' Star e.g. the Sun	3
Red Dwarf	4=
White Dwarf	4=

* 1 = most bright, 4 = least bright

In answering questions (d) and (e) below, you should refer specifically to the amplitude and/or the frequency of light waves.

d. What is the difference between the light waves emitted by a Red Giant and a Red Dwarf?

.....
.....

(1)

e. What is the difference between the light waves emitted by a Red Dwarf and a White Dwarf?

.....
.....
.....

(2)

- f. The Moon is 0.38 million km from Earth. Scientists have successfully fired a laser beam at mirrors left on the moon by Apollo astronauts and detected the subsequent reflection. Calculate the time interval between the firing of the laser beam and the detection of the reflection.

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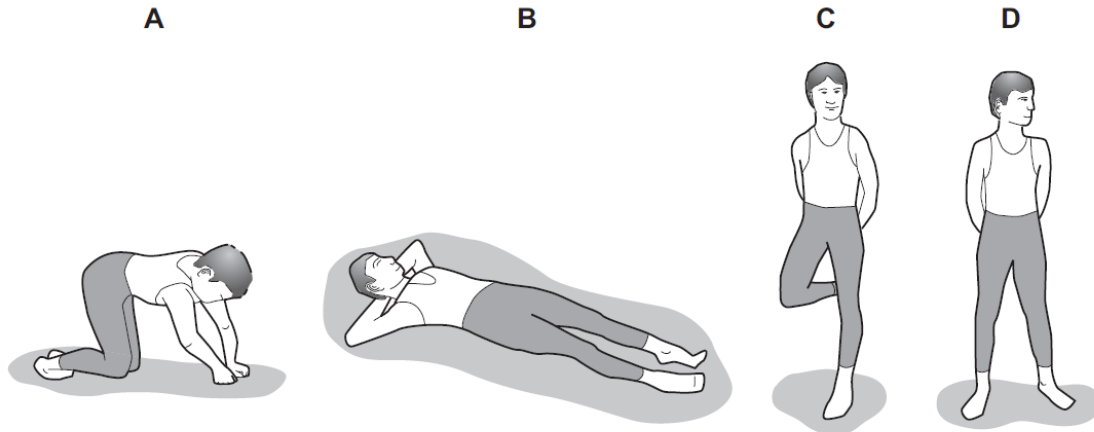
(3)

(Total 9 marks)

Physics Multiple Choice Section

For each of the questions in this section, circle the letter that corresponds to the correct answer.

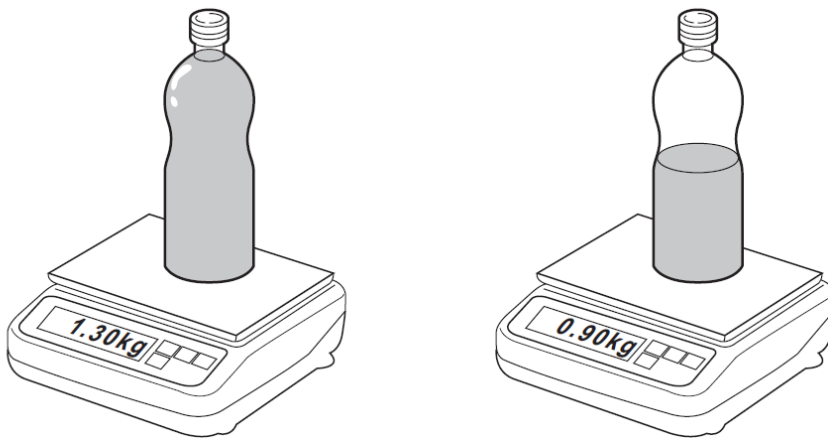
23. Which diagram shows an athlete exerting least pressure on the ground?



(Total 1 mark)

24. The mass of a full bottle of cooking oil is 1.30 kg.

When exactly half of the oil has been used, the mass of the bottle plus the remaining oil is 0.90 kg.

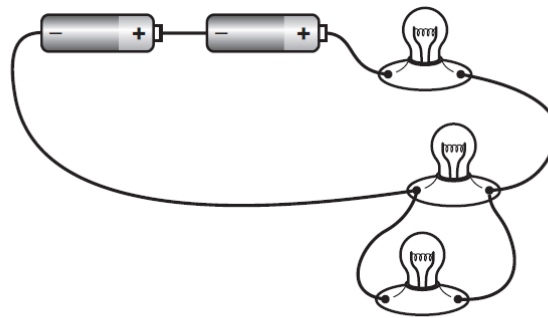


What is the mass of the empty bottle?

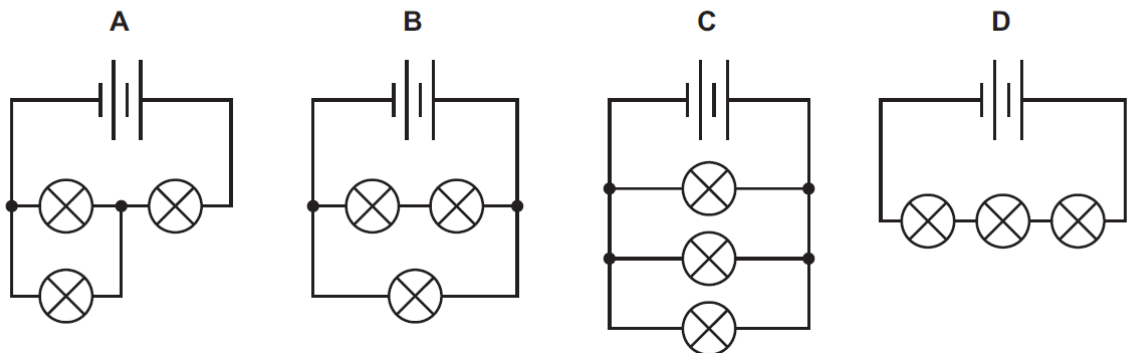
- A 0.40 kg
- B 0.50 kg
- C 0.65 kg
- D 0.80 kg

(Total 1 mark)

25. A student sets up a circuit containing a battery of two cells and three lamps, as shown.

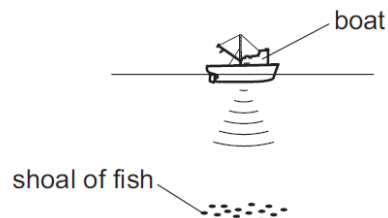


What is the circuit diagram for this arrangement?



(Total 1 mark)

26. A pulse of sound is produced at the bottom of a boat. The sound travels through the water and is reflected from a shoal of fish. The sound reaches the boat again after 1.2 s. The speed of sound in water is 1500 m/s.

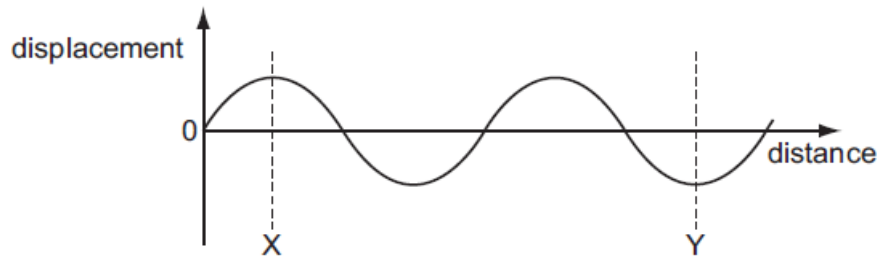


How far below the bottom of the boat is the shoal of fish?

- A** 450 m **B** 900 m **C** 1800 m **D** 3600 m

(Total 1 mark)

27. The diagram represents a wave.

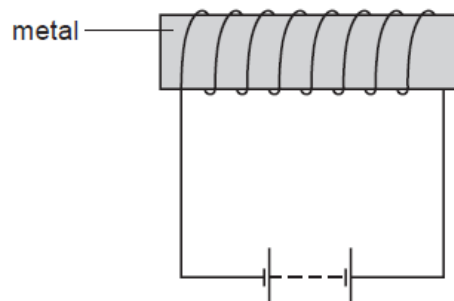


How many wavelengths are there between X and Y?

- A** $\frac{2}{3}$ **B** 1 **C** $1\frac{1}{2}$ **D** 3

(Total 1 mark)

28. A student wishes to use a magnetising coil to make a permanent magnet from a piece of metal

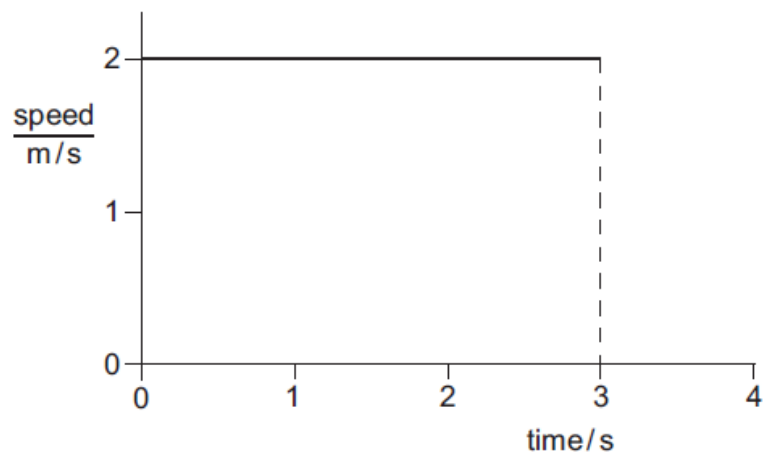


Which metal should she use?

- A** aluminium
B copper
C iron
D steel

(Total 1 mark)

29. The diagram shows the speed-time graph for an object moving at constant speed.

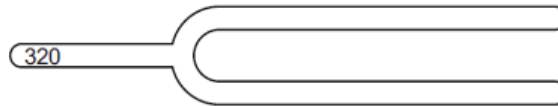


What is the distance travelled by the object in the first 3 s?

- A** 1.5m **B** 2.0m **C** 3.0m **D** 6.0m

(Total 1 mark)

30. A tuning fork is marked with the number 320.



This indicates the size of the frequency.

What does this mean?

- A The length of the tuning fork is 320 mm.
- B The note from the tuning fork will last for up to 320 s.
- C The sound waves produced by the tuning fork travel at 320 m/s.
- D The tuning fork vibrated 320 times every second.

(Total 1 mark)

31. The circuit of a motor racing track is 3 km in length. In a race, a car goes 25 times round the circuit in 30 minutes.

What is the average speed of the car?

- A 75 km/hour
- B 90 km/hour
- C 150 km/hour
- D 750 km/hour

(Total 1 mark)

32. A polythene rod repels an inflated balloon hanging from a nylon thread.

What charges must the rod and balloon carry?

- A The rod and the balloon carry opposite charges.
- B The rod and the balloon carry like charges.
- C The rod is charged but the balloon is not.
- D The balloon is charged by the rod is not.

(Total 1 mark)