

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B623/02

ADDITIONAL SCIENCE B

Unit 1 Modules B3 C3 P3 (Higher Tier)

Candidates answer on the Question Paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:

- Pencil
- Ruler (cm/mm)

Wednesday 26 May 2010
Morning

Duration: 1 hour



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

2

EQUATIONS

$$\text{speed} = \frac{\text{distance}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2} mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

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Question 1 begins on page 4.

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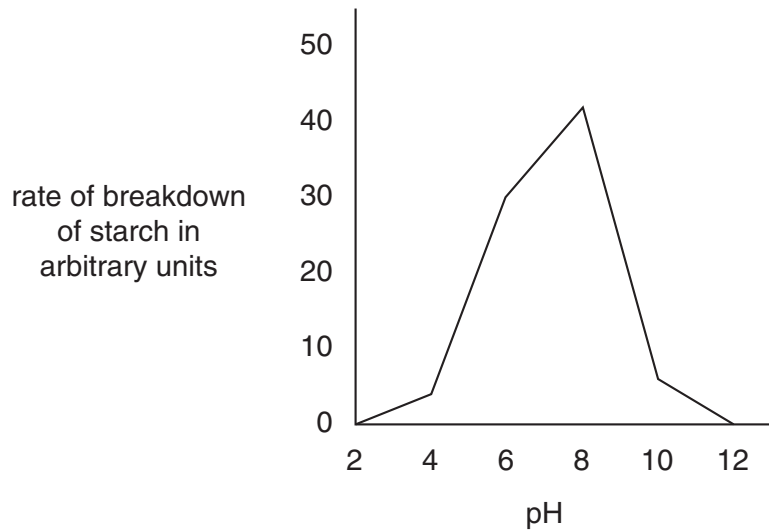
Answer **all** the questions.

Section A – Module B3

1 In the digestive system, the carbohydrate starch is broken down into sugar.

This begins in the mouth and uses the enzyme amylase.

(a) The graph shows how the rate of breakdown of starch by amylase changes as the pH increases.



Look at the graph.

(i) Describe how the rate of breakdown of starch changes as the pH increases.

.....
.....
..... [2]

(ii) Write down the optimum pH of amylase.

..... [1]

(iii) Food passes from the mouth to the stomach and then to the small intestine.

The table shows the pH at these different parts of the digestive system.

part of the digestive system	typical pH
mouth	7
stomach	2
small intestine	6

Some amylase is made in the mouth.

Amylase is also made in the pancreas and passed into the small intestine.

Suggest why more amylase has to be made in the pancreas.

.....
.....
..... [2]

(b) Sugar is absorbed from the small intestine into the blood.

(i) Write down the name of this absorption process.

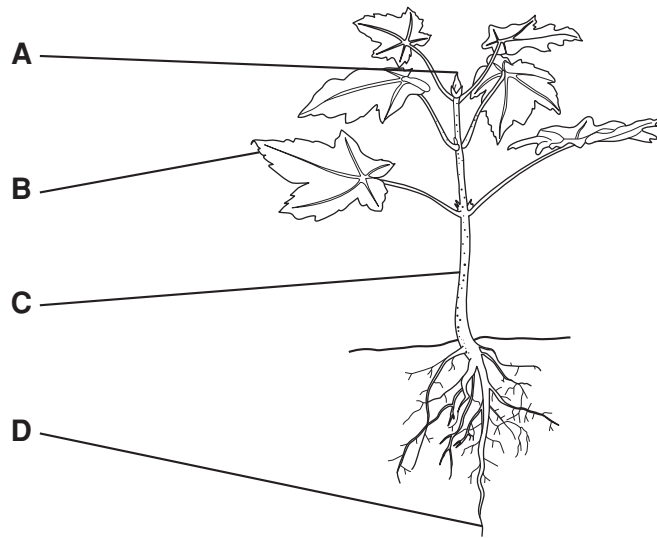
.....
What causes sugar to be absorbed by this process?
.....
..... [2]

(ii) Which part of the blood transports sugar?

..... [1]

[Total: 8]

2 The diagram shows a growing geranium plant.



(a) (i) **Cell division** is one way in which plants grow.

In which two parts of a plant does **most** cell division occur?

Look at the diagram.

Choose **two** from **A, B, C** and **D**.

..... and

[1]

(ii) Write down the name of this type of cell division.

..... [1]

(b) The shoot and root of a plant grow differently in response to light and gravity.

Put **four** ticks (✓) in the table to show the responses shown by a shoot and a root.

	positive geotropism	negative geotropism	positive phototropism	negative phototropism
shoot				
root				

[2]

(c) Paul wants to grow more geranium plants by tissue culture.

He uses very small pieces of the shoot to grow into new plants.

(i) New plants can be grown by tissue culture.

Animals like sheep **cannot** be grown by tissue culture.

Explain why sheep cannot be grown by tissue culture.

.....
..... [1]

(ii) Paul can also grow new geranium plants from seeds.

Write down **one advantage** of growing new geranium plants by tissue culture rather than by using seeds.

.....
..... [1]

[Total: 6]

3 Liz has diabetes.

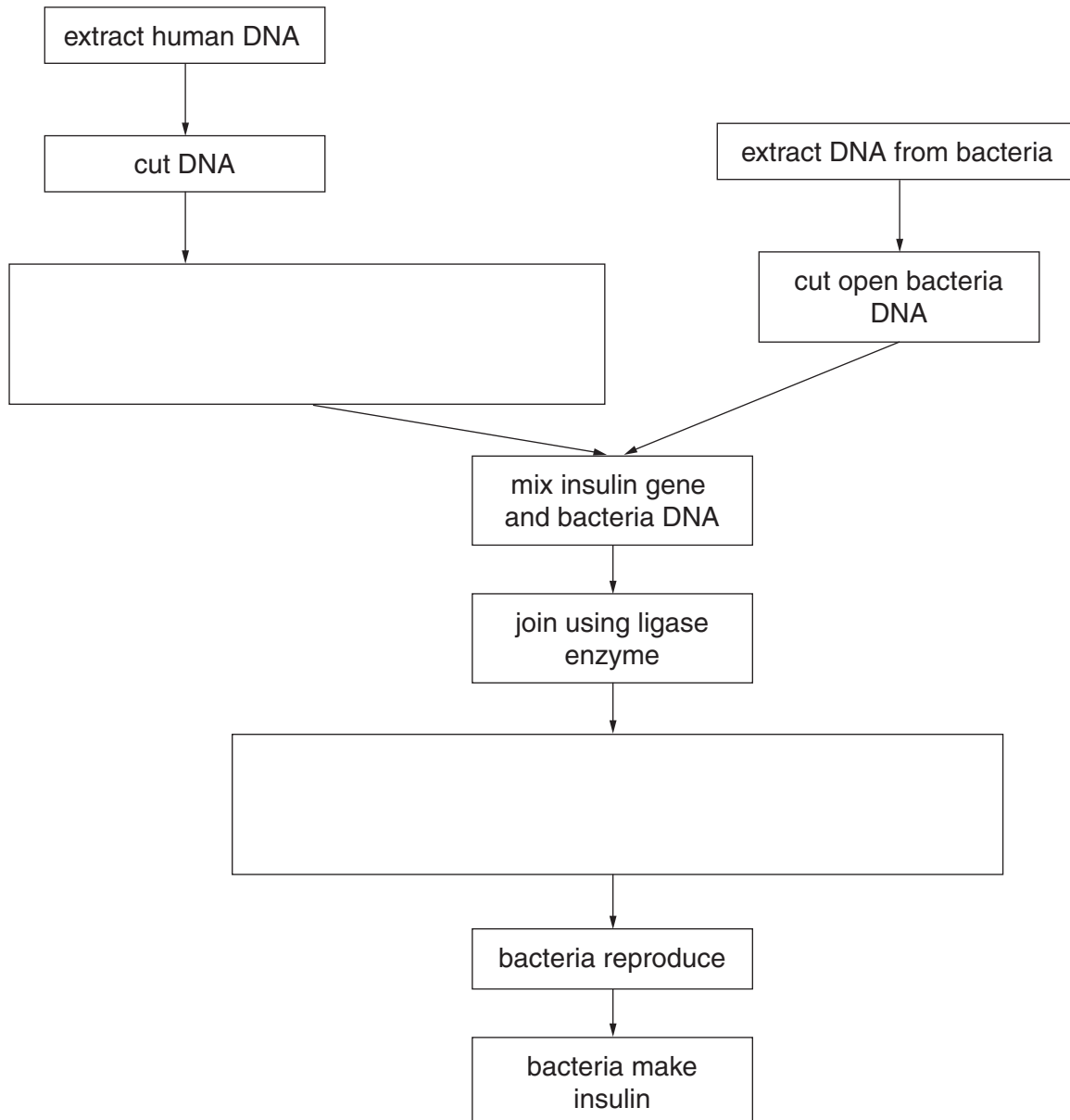
The cells in her pancreas do **not** make the hormone insulin.

She has to inject herself regularly with insulin.

She uses insulin from genetically engineered bacteria.

(a) The flow chart shows how bacteria are genetically engineered to make insulin.

(i) Complete the flow chart by writing in the **two** boxes.



[2]

(ii) The insulin that the bacteria make is identical to the insulin that humans make.

Explain why.

.....
..... [1]

(iii) Some people object to genetic engineering.

Write down **one** reason why.

.....
..... [1]

(b) When bacteria cells grow to a certain size, they divide into smaller cells.

This is because if they get too big they **cannot** survive.

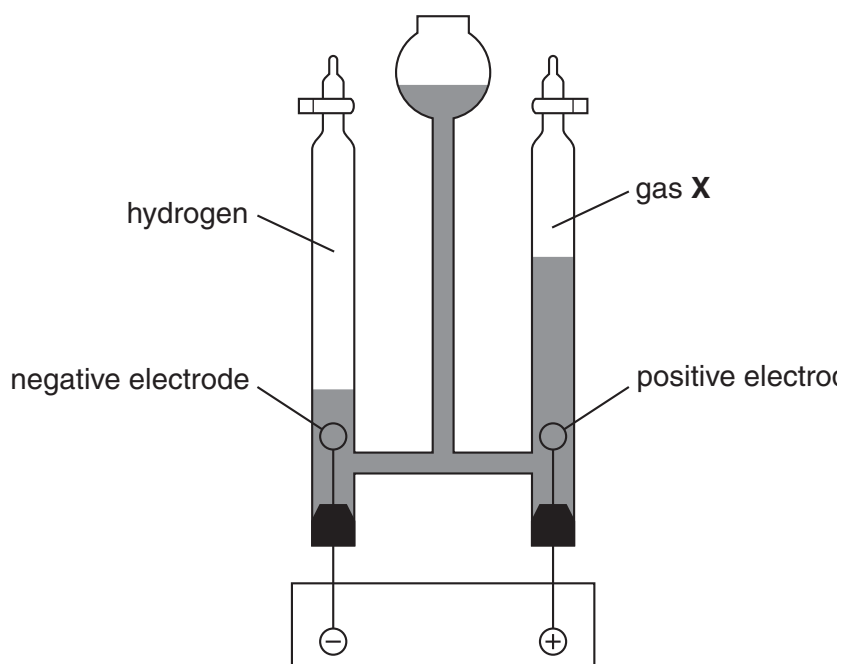
Explain why cells that are too big cannot survive.

.....
.....
..... [2]

[Total: 6]

Section B – Module C3

- 4 Look at the diagram. It shows the apparatus used to electrolyse dilute sulfuric acid.



- (a) Gas X is made at the positive electrode.

- (i) Write down the name of gas X.

..... [1]

- (ii) Hydrogen is made at the negative electrode.

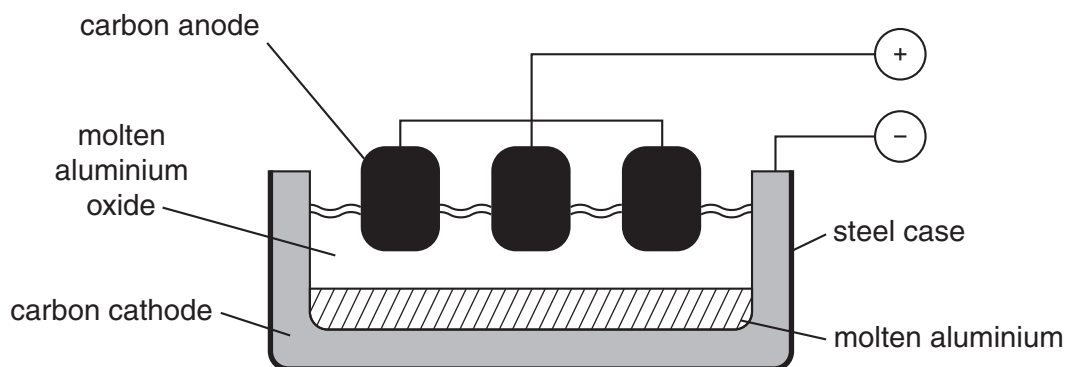
Hydrogen ions, H^+ , gain electrons, e^- , to make a hydrogen molecule, H_2 .

Write a balanced **symbol** equation for this reaction.

..... [2]

(b) Electrolysis is also used to make aluminium.

Look at the diagram. It shows the equipment that is used.



(i) Aluminium is made at one of the electrodes.

Which one?

..... [1]

(ii) The electrolyte is aluminium oxide mixed with cryolite.

Why is cryolite mixed with the aluminium oxide?

..... [1]

(iii) Aluminium is a very expensive metal to make.

Explain why.

.....
 [1]

[Total: 6]

- 5 Alice and Jamie investigate some reactions of the Group 7 elements.

Chlorine and bromine are Group 7 elements.

- (a) Look at the table.

It shows what is made when Group 7 elements react with Group 1 elements.

Complete the table.

	name of compound made in reaction with	
	chlorine	bromine
sodium	sodium chloride
potassium	potassium bromide

[2]

- (b) Write a **word** equation for the reaction of sodium with chlorine.

..... [1]

- (c) The Group 7 elements have 7 electrons in their outer shell.

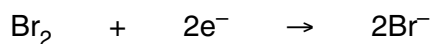
Chlorine is more reactive than bromine.

Explain why. Use ideas about the gain of electrons.

.....

..... [1]

- (d) Bromine reacts to make bromide ions.



This process is called **reduction**.

Explain why.

.....

..... [1]

[Total: 5]

6 This question is about transition elements.

(a) The compounds of transition elements are often coloured.

Draw a straight line to match each **compound** to its **colour**.

compound	colour
iron(III) sulfate	orange / brown
copper sulfate	pale green
iron(II) sulfate	blue

[2]

(b) Mercury is a transition element.

Mercury is a **superconductor** at very low temperatures.

Superconductors are materials that conduct electricity with little or no resistance.

Write about the **benefits** and **drawbacks** of using superconductors.

.....

.....

.....

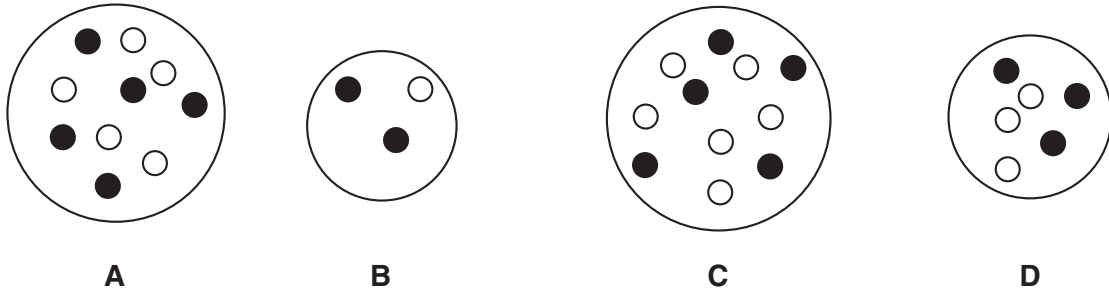
.....

..... [3]

[Total: 5]

7 This question is about atomic structure and bonding.

(a) Look at the diagrams. Each diagram shows the nucleus of a different atom.



● = proton
○ = neutron

(i) Which nucleus has a mass number of 3?

Choose from **A**, **B**, **C** and **D**.

answer

[1]

(ii) Which are isotopes of the same element?

..... and

[1]

(b) Oxygen atoms have the electronic structure 2. 6.

Hydrogen atoms have the electronic structure 1.

Draw a dot and cross diagram to show the covalent bonding in a water molecule, H₂O.

[2]

[Total: 4]

15
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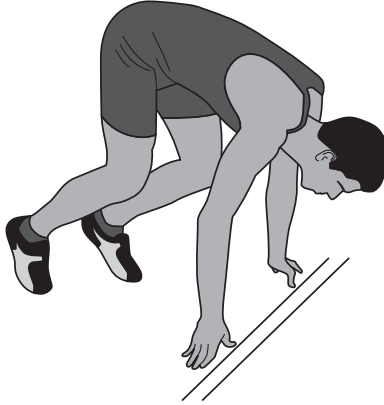
Question 8 begins on page 16.

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Section C – Module P3

- 8 Ibrahim is the fastest runner in his class.

He runs a 100 metre race.



- (a) Other pupils in his class are going to calculate his speed during the race.

They measure the **distance** he runs and the **time** he takes for the race.

The results are:

distance = 100 metres (m)

time = 12 seconds (s)

Calculate Ibrahim's **average** speed for the race.

The equations on page 2 may help you.

.....

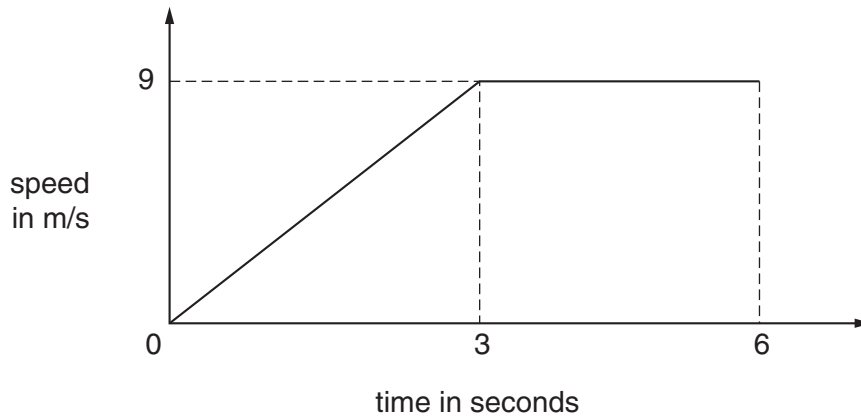
.....

.....

answer m/s

[2]

(b) Look at the graph of part of Ibrahim's race.



(i) Ibrahim's speed is 9 metres per second (m/s) after 3 seconds.

Calculate his acceleration during the first 3 seconds.

The equations on page 2 may help you.

.....

.....

.....

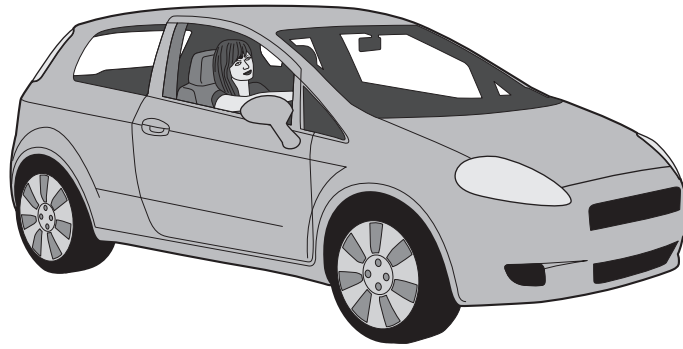
answer m/s² [2]

(ii) What can be calculated from the **area** under the line of the speed-time graph?

..... [1]

[Total: 5]

9 Julie is driving her car.



Julie approaches some traffic lights.

The lights change to red (stop). She stops the car quickly.

(a) Work is done when Julie applies the brakes.

While the brakes are applied

- the car travels 15 m
- the braking force is 4000 N.

Calculate the work done by the brakes.

The equations on page 2 may help you.

.....

.....

.....

.....

answer joules

[2]

(b) The traffic lights turn green. Julie pulls away from the lights.

She now drives the car at a higher speed.

Higher speed increases her braking distance. It also increases her thinking distance.

Write about **other** factors that could **increase**

- the braking distance
- the thinking distance.

.....

.....

..... [2]

(c) Look at the table about braking distances.

speed in m/s	braking distance in m
14	15
28	60
42	135

The braking distance increases as the speed increases.

Look at the table.

Explain in **detail** what happens to braking distance when the speed increases.

Use ideas about kinetic energy.

The equations on page 2 may help you.

.....

.....

.....

..... [2]

[Total: 6]

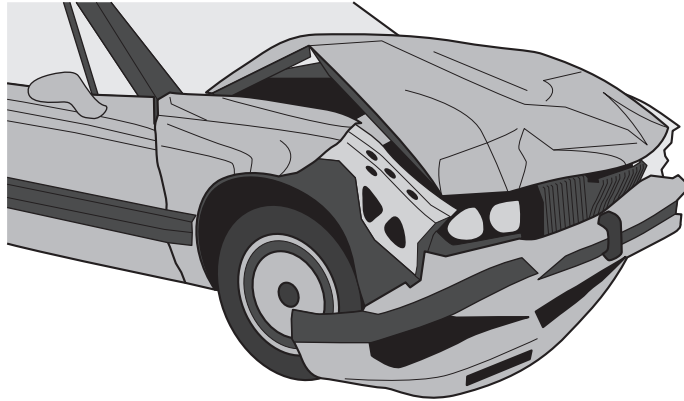
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10 Modern cars have safety features that absorb energy in a crash.

This reduces the forces on the driver.

One example of this is a crumple zone.



(a) Crumple zones reduce the force on the driver in a crash.

Write down **two** reasons why.

- 1
-
- 2
- [2]

(b) Crumple zones are a **passive** safety feature in a car.

ABS brakes are an example of an active safety feature.

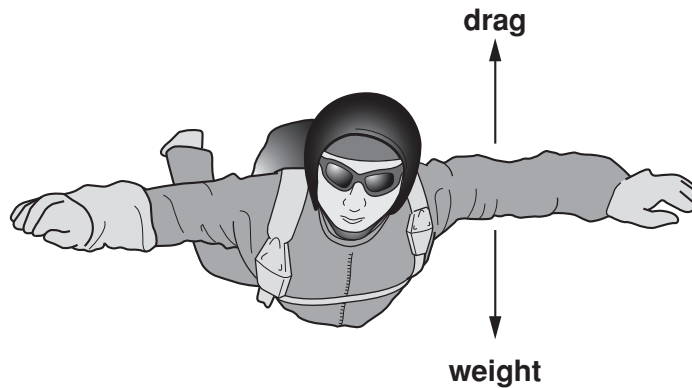
How do **active** safety features make driving safer?

..... [1]

[Total: 3]

11 Liz is a free-fall parachutist. Look at the drawing.

It shows the forces acting on Liz at the start of her free-fall.



Her weight is greater than the drag so she falls.

(a) What happens to the acceleration of free-fall (g) acting on Liz as she falls?

Choose from

decreases

increases

stays the same

answer [1]

(b) (i) Liz's drag force increases as she falls.

Explain why.

.....
 [1]

(ii) She spreads her body out flat. This increases the drag force.

Explain why.

.....
 [1]

(iii) Liz reaches a **terminal speed** as she falls.

There is a relationship between the forces acting on her.

What is the relationship between these forces at terminal speed?

..... [1]

(c) Liz falls at terminal speed.

(i) What happens to Liz's kinetic energy (KE) as she falls at terminal speed?

..... [1]

(ii) At terminal speed her potential energy (PE) decreases as she falls.

What happens to this energy?

..... [1]

[Total: 6]

END OF QUESTION PAPER



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The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10
19 K potassium 19	20 Ca calcium 20	21 Sc scandium 21	22 Ti titanium 22	23 V vanadium 23	24 Cr chromium 24	25 Mn manganese 25	26 Fe iron 26	27 Co cobalt 27
37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium [98]	44 Ru ruthenium 44	45 Rh rhodium 45
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	58 Hf hafnium 58	59 Ta tantalum 59	60 W tungsten 60	61 Re rhenium 61	62 Os osmium 62	63 Ir iridium 63
87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	90 Rf rutherfordium 90	91 Db dubnium 91	92 Sg seaborgium 92	93 Bh bohrium 93	94 Hs hassium 94	95 Mt meitnerium 95
133 Cs caesium 133	137 Ba barium 137	138 La* lanthanum 138	139 Hf hafnium 139	140 Ta tantalum 140	141 W tungsten 141	142 Re rhenium 142	143 Os osmium 143	144 Ir iridium 144
187 Rb rubidium 187	188 Sr strontium 188	189 Y yttrium 189	190 Zr zirconium 190	191 Nb niobium 191	192 Mo molybdenum 192	193 Tc technetium [98]	194 Ru ruthenium 194	195 Rh rhodium 195
223 Fr francium 223	226 Ra radium 226	227 Ac* actinium 227	228 Rf rutherfordium 228	229 Db dubnium 229	230 Sg seaborgium 230	231 Bh bohrium 231	232 Hs hassium 232	233 Mt meitnerium 233
285 Fr francium 285	286 Ra radium 286	287 Ac* actinium 287	288 Rf rutherfordium 288	289 Db dubnium 289	290 Sg seaborgium 290	291 Bh bohrium 291	292 Hs hassium 292	293 Mt meitnerium 293
337 Rb rubidium 337	338 Sr strontium 338	339 Y yttrium 339	340 Zr zirconium 340	341 Nb niobium 341	342 Mo molybdenum 342	343 Tc technetium [98]	344 Ru ruthenium 344	345 Rh rhodium 345
371 Rb rubidium 371	372 Sr strontium 372	373 Y yttrium 373	374 Zr zirconium 374	375 Nb niobium 375	376 Mo molybdenum 376	377 Tc technetium [98]	378 Ru ruthenium 378	379 Rh rhodium 379
431 Rb rubidium 431	432 Sr strontium 432	433 Y yttrium 433	434 Zr zirconium 434	435 Nb niobium 435	436 Mo molybdenum 436	437 Tc technetium [98]	438 Ru ruthenium 438	439 Rh rhodium 439
487 Rb rubidium 487	488 Sr strontium 488	489 Y yttrium 489	490 Zr zirconium 490	491 Nb niobium 491	492 Mo molybdenum 492	493 Tc technetium [98]	494 Ru ruthenium 494	495 Rh rhodium 495
547 Rb rubidium 547	548 Sr strontium 548	549 Y yttrium 549	550 Zr zirconium 550	551 Nb niobium 551	552 Mo molybdenum 552	553 Tc technetium [98]	554 Ru ruthenium 554	555 Rh rhodium 555
603 Rb rubidium 603	604 Sr strontium 604	605 Y yttrium 605	606 Zr zirconium 606	607 Nb niobium 607	608 Mo molybdenum 608	609 Tc technetium [98]	610 Ru ruthenium 610	611 Rh rhodium 611
659 Rb rubidium 659	660 Sr strontium 660	661 Y yttrium 661	662 Zr zirconium 662	663 Nb niobium 663	664 Mo molybdenum 664	665 Tc technetium [98]	666 Ru ruthenium 666	667 Rh rhodium 667
715 Rb rubidium 715	716 Sr strontium 716	717 Y yttrium 717	718 Zr zirconium 718	719 Nb niobium 719	720 Mo molybdenum 720	721 Tc technetium [98]	722 Ru ruthenium 722	723 Rh rhodium 723
771 Rb rubidium 771	772 Sr strontium 772	773 Y yttrium 773	774 Zr zirconium 774	775 Nb niobium 775	776 Mo molybdenum 776	777 Tc technetium [98]	778 Ru ruthenium 778	779 Rh rhodium 779
827 Rb rubidium 827	828 Sr strontium 828	829 Y yttrium 829	830 Zr zirconium 830	831 Nb niobium 831	832 Mo molybdenum 832	833 Tc technetium [98]	834 Ru ruthenium 834	835 Rh rhodium 835
883 Rb rubidium 883	884 Sr strontium 884	885 Y yttrium 885	886 Zr zirconium 886	887 Nb niobium 887	888 Mo molybdenum 888	889 Tc technetium [98]	890 Ru ruthenium 890	891 Rh rhodium 891
939 Rb rubidium 939	940 Sr strontium 940	941 Y yttrium 941	942 Zr zirconium 942	943 Nb niobium 943	944 Mo molybdenum 944	945 Tc technetium [98]	946 Ru ruthenium 946	947 Rh rhodium 947
995 Rb rubidium 995	996 Sr strontium 996	997 Y yttrium 997	998 Zr zirconium 998	999 Nb niobium 999	1000 Mo molybdenum 1000	1001 Tc technetium [98]	1002 Ru ruthenium 1002	1003 Rh rhodium 1003
1051 Rb rubidium 1051	1052 Sr strontium 1052	1053 Y yttrium 1053	1054 Zr zirconium 1054	1055 Nb niobium 1055	1056 Mo molybdenum 1056	1057 Tc technetium [98]	1058 Ru ruthenium 1058	1059 Rh rhodium 1059
1107 Rb rubidium 1107	1108 Sr strontium 1108	1109 Y yttrium 1109	1110 Zr zirconium 1110	1111 Nb niobium 1111	1112 Mo molybdenum 1112	1113 Tc technetium [98]	1114 Ru ruthenium 1114	1115 Rh rhodium 1115
1163 Rb rubidium 1163	1164 Sr strontium 1164	1165 Y yttrium 1165	1166 Zr zirconium 1166	1167 Nb niobium 1167	1168 Mo molybdenum 1168	1169 Tc technetium [98]	1170 Ru ruthenium 1170	1171 Rh rhodium 1171
1219 Rb rubidium 1219	1220 Sr strontium 1220	1221 Y yttrium 1221	1222 Zr zirconium 1222	1223 Nb niobium 1223	1224 Mo molybdenum 1224	1225 Tc technetium [98]	1226 Ru ruthenium 1226	1227 Rh rhodium 1227
1275 Rb rubidium 1275	1276 Sr strontium 1276	1277 Y yttrium 1277	1278 Zr zirconium 1278	1279 Nb niobium 1279	1280 Mo molybdenum 1280	1281 Tc technetium [98]	1282 Ru ruthenium 1282	1283 Rh rhodium 1283
1331 Rb rubidium 1331	1332 Sr strontium 1332	1333 Y yttrium 1333	1334 Zr zirconium 1334	1335 Nb niobium 1335	1336 Mo molybdenum 1336	1337 Tc technetium [98]	1338 Ru ruthenium 1338	1339 Rh rhodium 1339
1387 Rb rubidium 1387	1388 Sr strontium 1388	1389 Y yttrium 1389	1390 Zr zirconium 1390	1391 Nb niobium 1391	1392 Mo molybdenum 1392	1393 Tc technetium [98]	1394 Ru ruthenium 1394	1395 Rh rhodium 1395
1443 Rb rubidium 1443	1444 Sr strontium 1444	1445 Y yttrium 1445	1446 Zr zirconium 1446	1447 Nb niobium 1447	1448 Mo molybdenum 1448	1449 Tc technetium [98]	1450 Ru ruthenium 1450	1451 Rh rhodium 1451
1499 Rb rubidium 1499	1500 Sr strontium 1500	1501 Y yttrium 1501	1502 Zr zirconium 1502	1503 Nb niobium 1503	1504 Mo molybdenum 1504	1505 Tc technetium [98]	1506 Ru ruthenium 1506	1507 Rh rhodium 1507
1555 Rb rubidium 1555	1556 Sr strontium 1556	1557 Y yttrium 1557	1558 Zr zirconium 1558	1559 Nb niobium 1559	1560 Mo molybdenum 1560	1561 Tc technetium [98]	1562 Ru ruthenium 1562	1563 Rh rhodium 1563
1611 Rb rubidium 1611	1612 Sr strontium 1612	1613 Y yttrium 1613	1614 Zr zirconium 1614	1615 Nb niobium 1615	1616 Mo molybdenum 1616	1617 Tc technetium [98]	1618 Ru ruthenium 1618	1619 Rh rhodium 1619
1667 Rb rubidium 1667	1668 Sr strontium 1668	1669 Y yttrium 1669	1670 Zr zirconium 1670	1671 Nb niobium 1671	1672 Mo molybdenum 1672	1673 Tc technetium [98]	1674 Ru ruthenium 1674	1675 Rh rhodium 1675
1723 Rb rubidium 1723	1724 Sr strontium 1724	1725 Y yttrium 1725	1726 Zr zirconium 1726	1727 Nb niobium 1727	1728 Mo molybdenum 1728	1729 Tc technetium [98]	1730 Ru ruthenium 1730	1731 Rh rhodium 1731
1779 Rb rubidium 1779	1780 Sr strontium 1780	1781 Y yttrium 1781	1782 Zr zirconium 1782	1783 Nb niobium 1783	1784 Mo molybdenum 1784	1785 Tc technetium [98]	1786 Ru ruthenium 1786	1787 Rh rhodium 1787
1835 Rb rubidium 1835	1836 Sr strontium 1836	1837 Y yttrium 1837	1838 Zr zirconium 1838	1839 Nb niobium 1839	1840 Mo molybdenum 1840	1841 Tc technetium [98]	1842 Ru ruthenium 1842	1843 Rh rhodium 1843
1891 Rb rubidium 1891	1892 Sr strontium 1892	1893 Y yttrium 1893	1894 Zr zirconium 1894	1895 Nb niobium 1895	1896 Mo molybdenum 1896	1897 Tc technetium [98]	1898 Ru ruthenium 1898	1899 Rh rhodium 1899
1947 Rb rubidium 1947	1948 Sr strontium 1948	1949 Y yttrium 1949	1950 Zr zirconium 1950	1951 Nb niobium 1951	1952 Mo molybdenum 1952	1953 Tc technetium [98]	1954 Ru ruthenium 1954	1955 Rh rhodium 1955
2003 Rb rubidium 2003	2004 Sr strontium 2004	2005 Y yttrium 2005	2006 Zr zirconium 2006	2007 Nb niobium 2007	2008 Mo molybdenum 2008	2009 Tc technetium [98]	2010 Ru ruthenium 2010	2011 Rh rhodium 2011
2059 Rb rubidium 2059	2060 Sr strontium 2060	2061 Y yttrium 2061	2062 Zr zirconium 2062	2063 Nb niobium 2063	2064 Mo molybdenum 2064	2065 Tc technetium [98]	2066 Ru ruthenium 2066	2067 Rh rhodium 2067
2115 Rb rubidium 2115	2116 Sr strontium 2116	2117 Y yttrium 2117	2118 Zr zirconium 2118	2119 Nb niobium 2119	2120 Mo molybdenum 2120	2121 Tc technetium [98]	2122 Ru ruthenium 2122	2123 Rh rhodium 2123
2171 Rb rubidium 2171	2172 Sr strontium 2172	2173 Y yttrium 2173	2174 Zr zirconium 2174	2175 Nb niobium 2175	2176 Mo molybdenum 2176	2177 Tc technetium [98]	2178 Ru ruthenium 2178	2179 Rh rhodium 2179
2227 Rb rubidium 2227	2228 Sr strontium 2228	2229 Y yttrium 2229	2230 Zr zirconium 2230	2231 Nb niobium 2231	2232 Mo molybdenum 2232	2233 Tc technetium [98]	2234 Ru ruthenium 2234	2235 Rh rhodium 2235
2283 Rb rubidium 2283	2284 Sr strontium 2284	2285 Y yttrium 2285	2286 Zr zirconium 2286	2287 Nb niobium 2287	2288 Mo molybdenum 2288	2289 Tc technetium [98]	2290 Ru ruthenium 2290	2291 Rh rhodium 2291
2339 Rb rubidium 2339	2340 Sr strontium 2340	2341 Y yttrium 2341	2342 Zr zirconium 2342	2343 Nb niobium 2343	2344 Mo molybdenum 2344	2345 Tc technetium [98]	2346 Ru ruthenium 2346	2347 Rh rhodium 2347
2395 Rb rubidium 2395	2396 Sr strontium 2396	2397 Y yttrium 2397	2398 Zr zirconium 2398	2399 Nb niobium 2399	2400 Mo molybdenum 2400	2401 Tc technetium [98]	2402 Ru ruthenium 2402	2403 Rh rhodium 2403
2451 Rb rubidium 2451	2452 Sr strontium 2452	2453 Y yttrium 2453	2454 Zr zirconium					