



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

\* 9 4 1 3 9 5 4 2 2 8 \*

**COMBINED SCIENCE**

**0653/21**

Paper 2 (Core)

**October/November 2013**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **23** printed pages and **1** blank page.



1 Sodium chloride is obtained from underground deposits in the Earth's crust or in aqueous solutions such as sea water.

(a) (i) Explain why the Earth's crust contains the compound sodium chloride and not the uncombined elements, sodium and chlorine.

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

(ii) State **one** difference between a compound and an element.

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

(iii) Describe how crystals of sodium chloride could be obtained from a salt solution.

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

(b) The chemical formula of the compound calcium fluoride is  $\text{CaF}_2$ .

Explain the meaning of the numbers in this formula.

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

(c) Fig. 1.1 shows apparatus used to separate the element lead from the compound lead bromide.

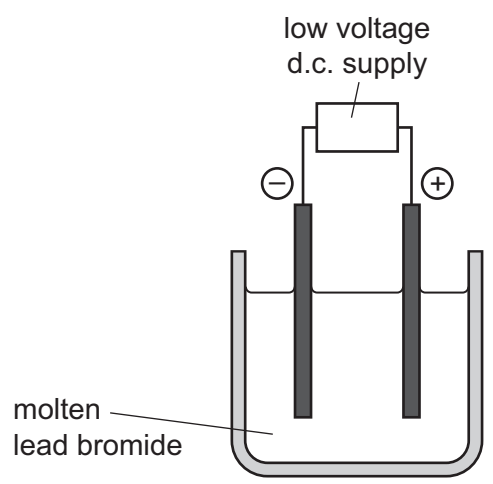


Fig. 1.1

(i) Name the process shown in Fig. 1.1.

..... [1]

(ii) Explain why an orange-coloured gas is observed rising from the molten lead bromide during the process.

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

2 Fig. 2.1 shows the inside of a refrigerator.

The temperature inside the freezing compartment is  $-20^{\circ}\text{C}$  and the temperature in the rest of the refrigerator is  $+5^{\circ}\text{C}$ .

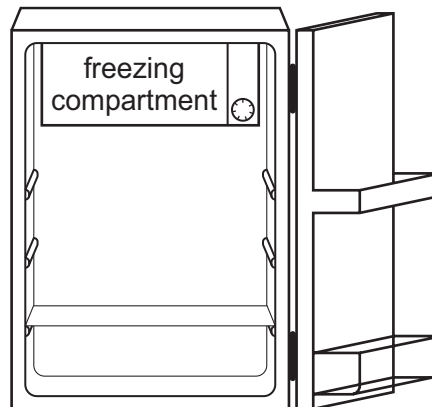


Fig. 2.1

(a) The air in the refrigerator is cooled by convection.

Draw **one** arrow on Fig. 2.1 to show the movement of the air cooled by the freezing compartment. [1]

(b) The volume of air in the refrigerator is  $0.15\text{ m}^3$ .

The density of air is  $1.26\text{ kg/m}^3$ .

Calculate the mass of air in the refrigerator.

State the formula that you use and show your working.

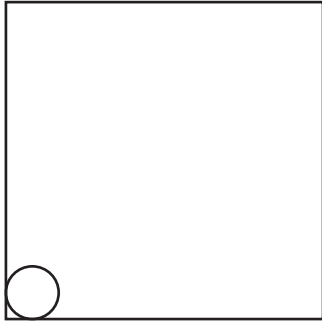
formula

working

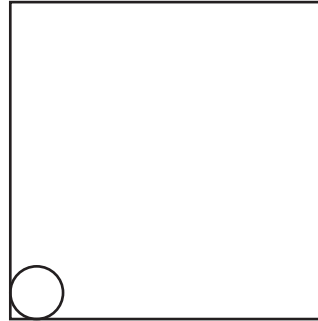
..... kg [2]

- (c) (i) Complete the diagrams to show the arrangement of water molecules in solid ice and in liquid water.

One molecule has been drawn for you in each box. Each diagram should contain at least twelve water molecules.



solid ice



liquid water

[2]

- (ii) Each sentence describes either a solid, a liquid or a gas.

In the right hand column write the letter **S** for solid, **L** for liquid or **G** for gas to match the description.

description	<b>S, L or G</b>
It cannot flow.	
It cannot transfer heat by convection.	
It contains particles which are widely separated.	
It expands the most when heated.	
It fills a closed container.	
It has a fixed volume but not a fixed shape.	

[2]

3 The concentration of glucose in the blood does not normally vary much. The hormone adrenaline causes blood glucose concentration to increase.

(a) (i) Define the term *hormone*.

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

(ii) State **one** effect of adrenaline on the body, other than increasing the concentration of glucose in the blood.

..... [1]

(b) Researchers investigated how adding fibre to foods affected the concentration of glucose in the blood after eating.

Fig. 3.1 shows the results that they obtained for two different types of cornflakes. Cornflakes contain a lot of starch.

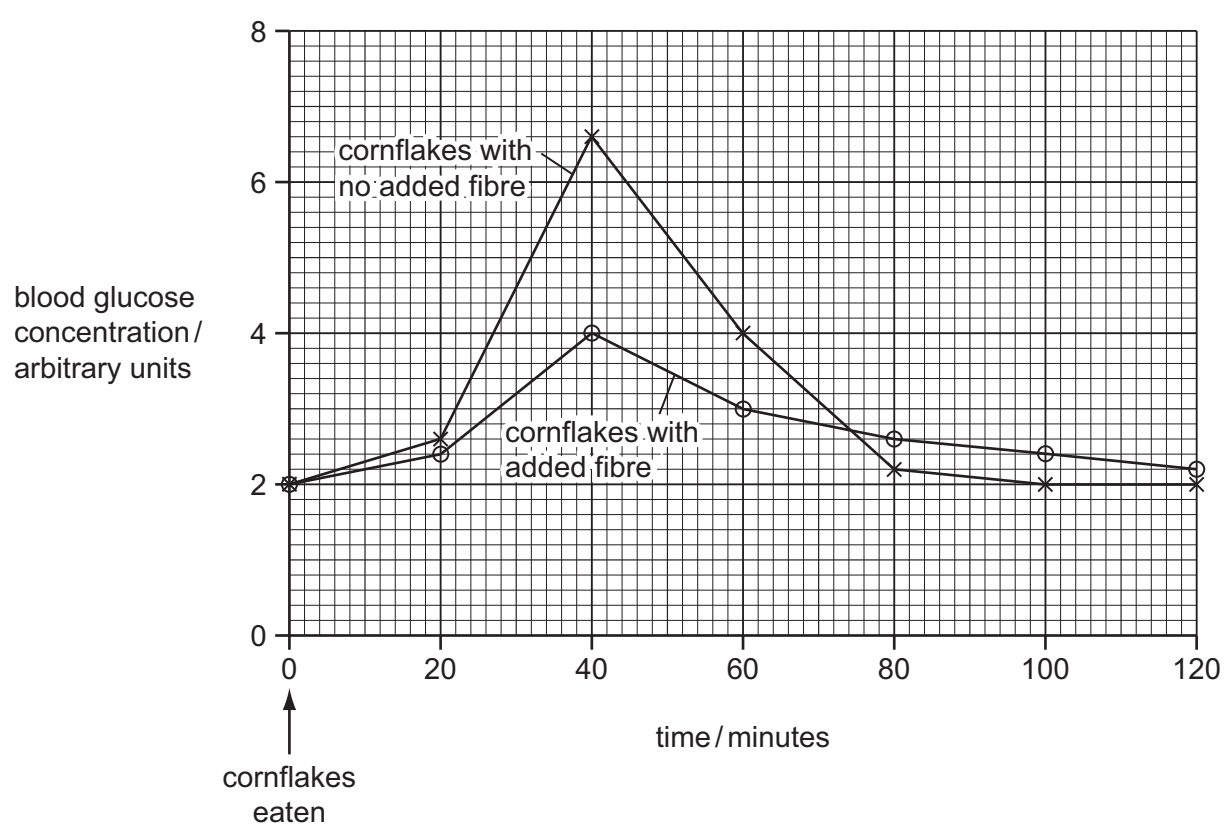


Fig. 3.1

Use the information in Fig. 3.1 to help you to answer the following questions.

- (i) Describe how the blood glucose concentration changed after eating cornflakes with no added fibre.

.....

.....

.....

.....

..... [3]

- (ii) Describe how adding fibre to the cornflakes affected the changes in blood glucose concentration after eating.

.....

.....

.....

.....

..... [3]

- (c) Outline **one** other way in which fibre in the diet affects health.

.....

..... [1]

4 Fig. 4.1 shows a period in the Periodic Table. Four elements are represented by which are not their usual chemical symbols.

group number	1	2	3	4	5	6	7	0
	W	X					Y	Z

Fig. 4.1

(a) (i) State and explain which of the elements, chosen from **W**, **X**, **Y** and **Z**, are poor conductors of electricity.

element(s) .....

explanation .....

..... [2]

(ii) One of the elements shown in Fig. 4.1 is **not** expected to form a compound with any of the others.

State and explain which **one** of the elements this is.

element .....

explanation .....

..... [2]



(b) Fig. 4.2 shows the melting points of four metallic elements from the same group in the Periodic Table.

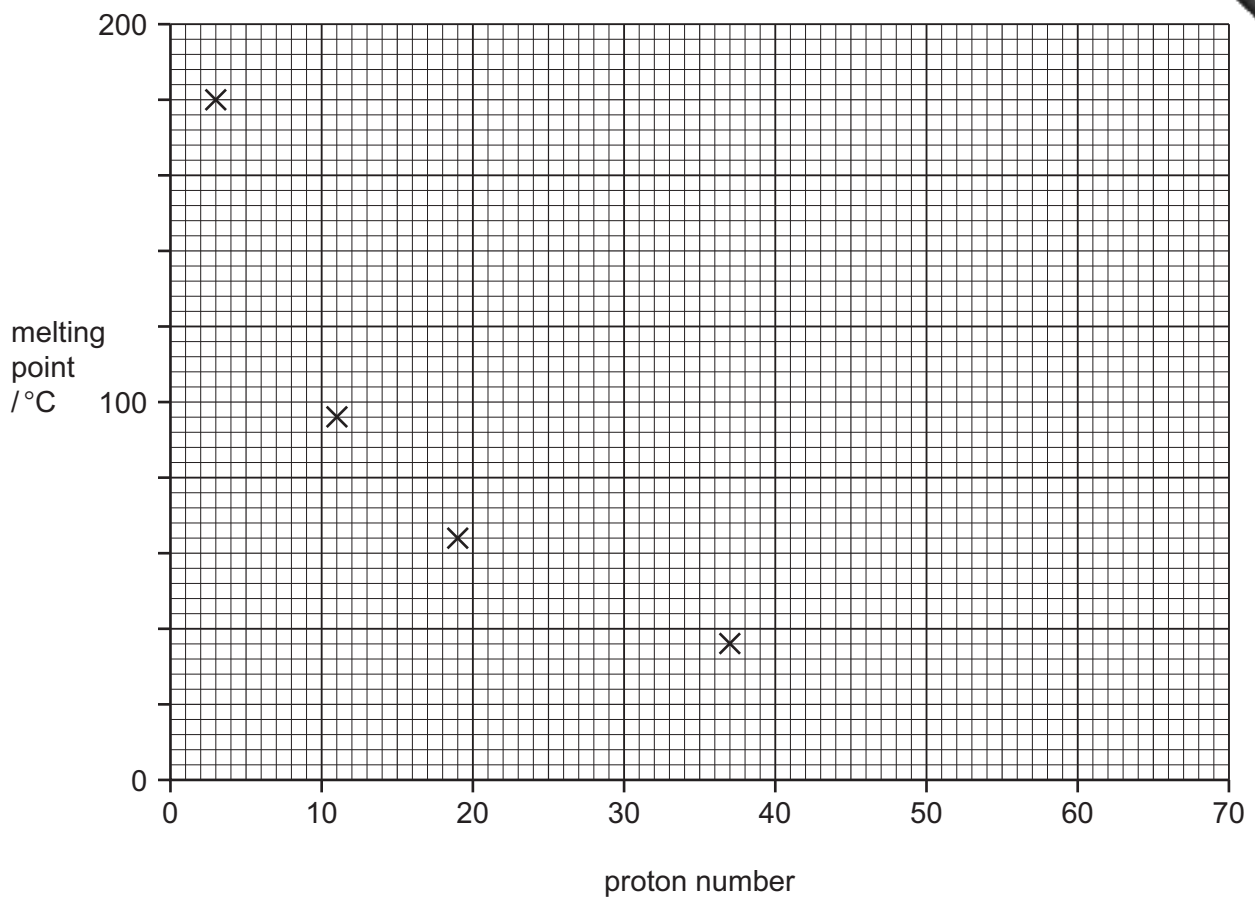


Fig. 4.2

(i) State the number of the group that contains the elements whose melting points are shown in Fig. 4.2.

Explain your answer briefly.

group number .....

explanation ..... [2]

(ii) Use the Periodic Table on page 24 to name the element in Fig. 4.2 that has the lowest melting point.

..... [1]

(c) (i) Copper oxide is a black solid which is insoluble in water.

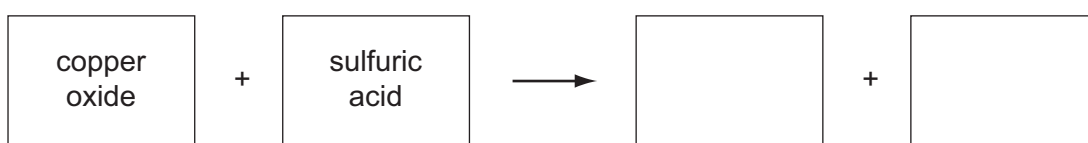
A student added excess dilute sulfuric acid to some copper oxide and warmed the mixture.

The copper oxide disappeared and a clear blue solution remained.

State **one** observation which shows that a chemical change has occurred.

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

(ii) Complete the **word** chemical equation for the reaction between copper oxide and dilute sulfuric acid.



[2]

Please turn over for Question 5.

5 Fig. 5.1 shows a solar-powered vehicle which travelled 3000 km in 30 hours.

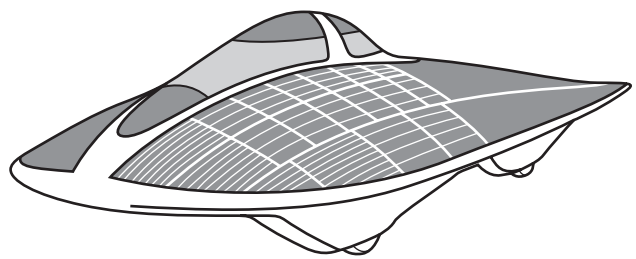


Fig. 5.1

(a) Calculate the average speed of the vehicle in km/hr.

State any formula that you use and show your working.

formula

working

..... km/hr [2]

(b) Fig. 5.2 shows a speed / time graph for part of the journey.

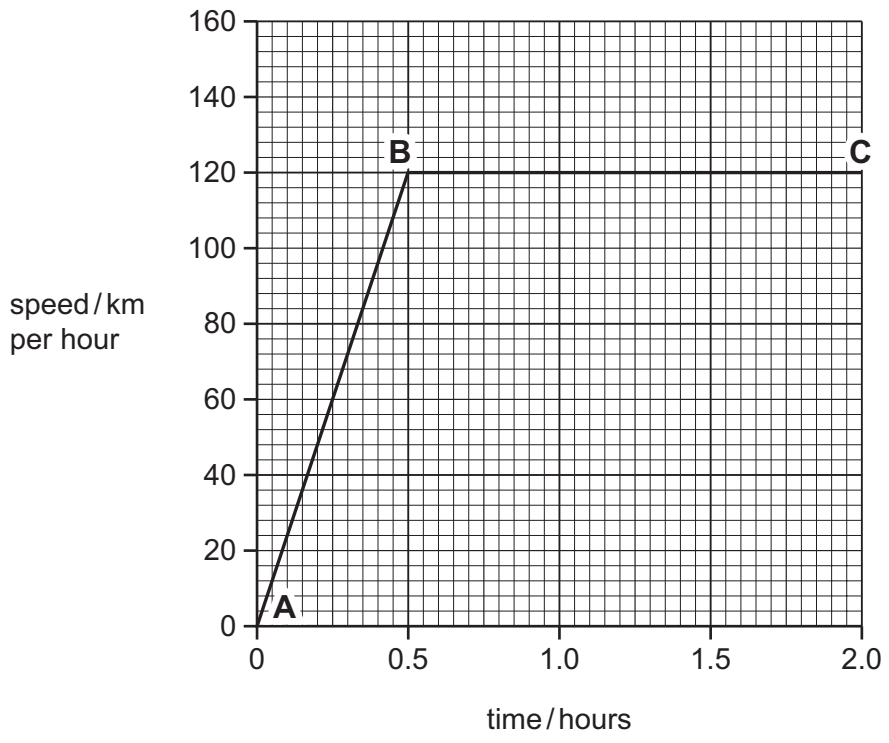


Fig. 5.2

(i) What was the maximum speed of the vehicle?

..... km/hr [1]

(ii) Describe the movement of the vehicle between A and B.

..... [1]

(c) Fig. 5.3 shows the energy flow diagram for the solar-powered vehicle.

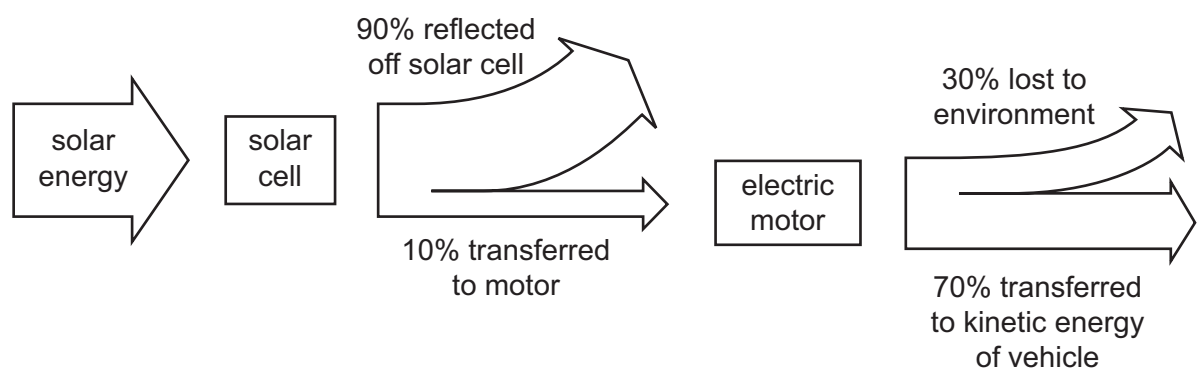


Fig. 5.3

During part of the journey, the **solar cell** receives 1 000 000 joules of solar energy.

Calculate the number of joules transferred as kinetic energy to the **vehicle**.

Show your working.

..... J [2]

(d) Solar energy is a renewable energy source.

(i) Name **one** other renewable energy source.

..... [1]

(ii) Describe **one** advantage to the environment of using solar energy as a renewable energy source.

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

6 Fig. 6.1 shows a section through the heart.

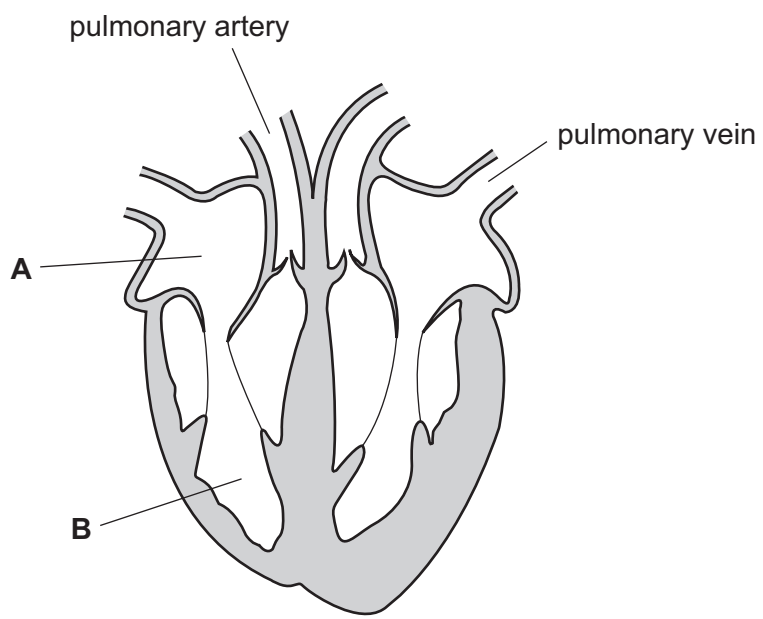


Fig. 6.1

(a) Name the parts labelled **A** and **B**.

**A** .....

**B** ..... [2]

(b) The walls of the heart are made of muscle.

Explain how this muscle pushes blood out of the heart.

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

(c) Suggest why the muscle of the upper chambers of the heart is thinner than the muscle of the lower chambers of the heart.

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

(d) When the heart is beating more quickly than usual, it uses a lot of oxygen.

Suggest why the heart uses more oxygen when it is beating quickly.

.....

.....

.....

..... [2]

- 7 (a) (i) Name a raw material that provides us with hydrocarbons.

.....

- (ii) Explain the meaning of the term *hydrocarbon*.

.....

..... [1]

- (iii) Fig. 7.1 shows the chemical equation for the reaction between ethene and bromine, set out as molecular structures.

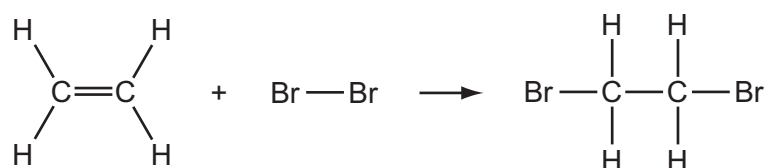
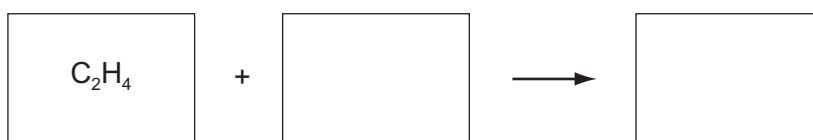


Fig. 7.1

Rewrite the information in Fig. 7.1 using chemical formulae. One chemical formula has been given.



[2]



(b) Propane is a gaseous hydrocarbon used as a fuel.

Fig. 7.2 shows a cross-section through a small furnace (kiln) in which items of pottery are being heated by a propane burner. The temperature inside the kiln is 950 °C.

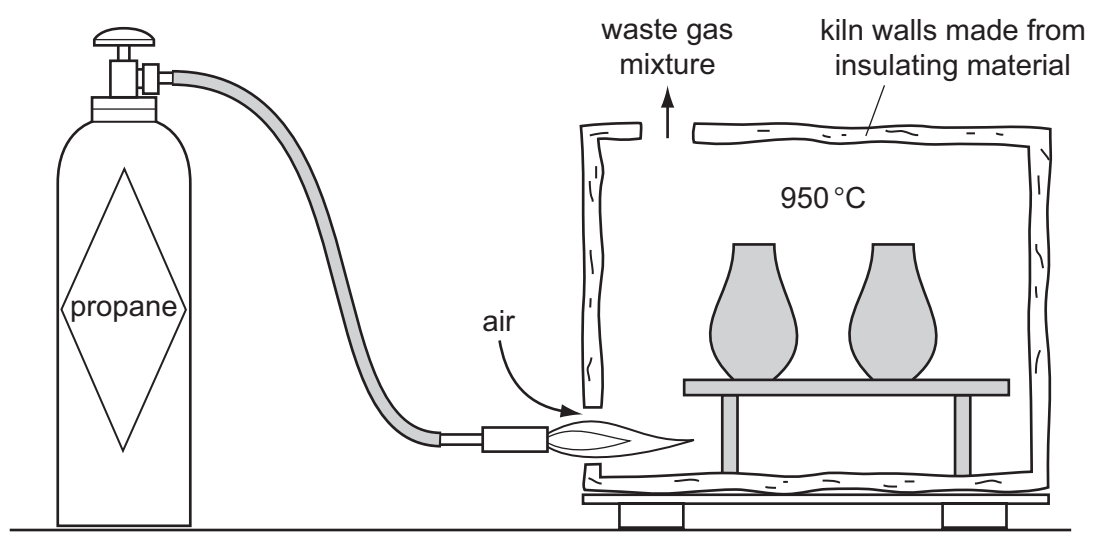


Fig. 7.2

(i) State which information from Fig. 7.2 shows that the combustion of propane is exothermic.

Explain your answer.

.....

.....

..... [2]

(ii) Suggest **two** compounds that have a higher concentration in the waste gas mixture than in the air drawn in at the bottom of the kiln.

Explain your answer briefly.

1 .....

2 .....

explanation .....

..... [3]

8 (a) Complete Table 8.1 below by drawing the circuit symbol for each electrical component.

Table 8.1

name of component	circuit symbol
open switch	
resistor	
voltmeter	
fuse	

[2]

(b) Fig. 8.1 shows an electrical hazard.

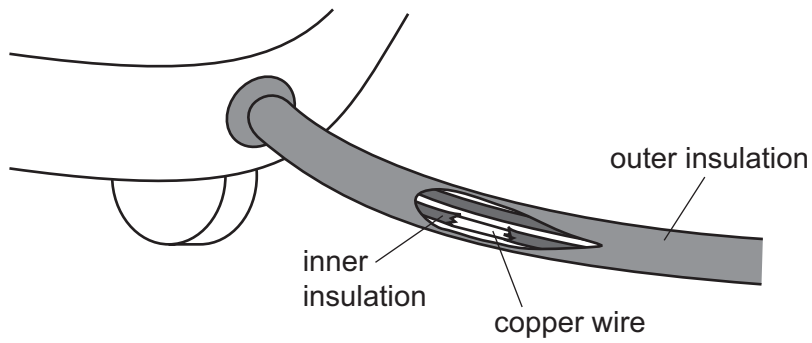


Fig. 8.1

State the hazard.

.....

.....

Explain why this situation is dangerous.

.....

.....

[2]

(c) In the circuit shown in Fig. 8.2 the reading on ammeter  $A_3$  is 0.5 A.

(i) State the current readings on ammeters  $A_1$  and  $A_2$ .

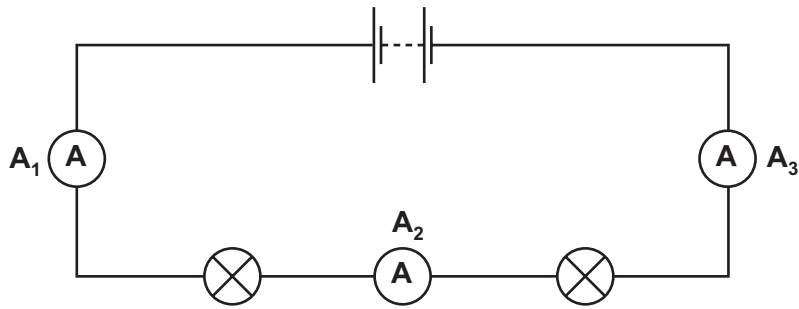


Fig. 8.2

$A_1$  ..... A

$A_2$  ..... A

[1]

(ii) Each lamp in the circuit has a resistance of  $5\Omega$ .

Calculate the combined resistance of the two lamps in the circuit.

State the formula that you use and show your working.

formula

working

.....  $\Omega$  [2]

9 (a) Fig. 9.1 shows a plant cell.

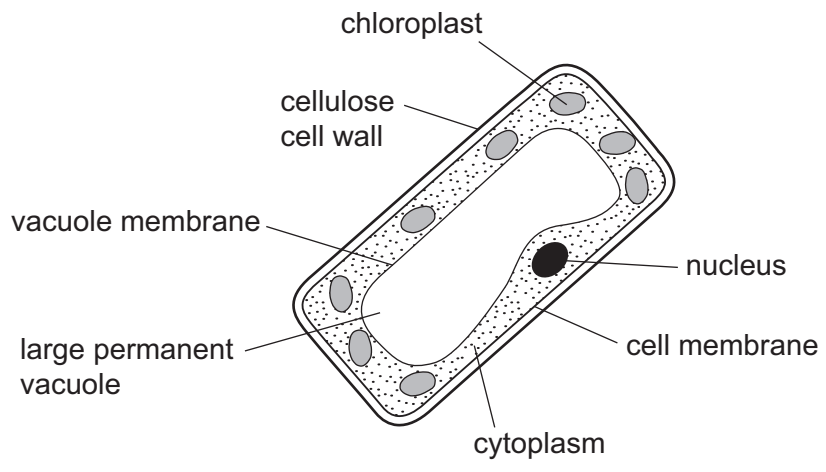


Fig. 9.1

(i) Describe the function of the cell membrane.

..... [1]

(ii) Name **two** structures labelled on Fig. 9.1 that are **not** found in animal cells.

1 .....

2 ..... [2]

(iii) Describe how photosynthesis is carried out in the cell shown in Fig. 9.1.

.....  
.....  
.....  
.....  
.....  
..... [3]

(b) About one tenth of the Earth's surface is covered by forests in which photosynthesis takes place.

List **three** ways in which extensive deforestation could harm the environment.

1 .....

.....

2 .....

.....

3 .....

..... [3]

10 (a) Fig. 10.1 represents the electromagnetic spectrum.

gamma rays	X-rays	ultraviolet	visible light	infra red	microwaves	radio waves
------------	--------	-------------	---------------	-----------	------------	-------------

Fig. 10.1

Name the type of electromagnetic wave that is used

(i) to send a signal to a TV from a remote control,

..... [1]

(ii) to send satellite TV information.

..... [1]

(b) Fig. 10.2 represents a wave.

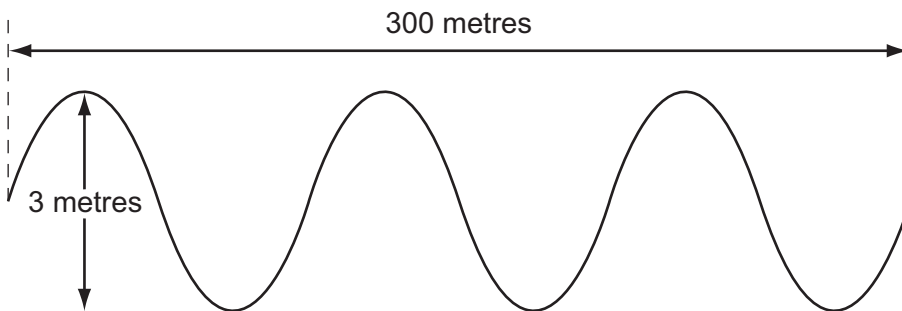


Fig. 10.2

Use Fig. 10.2 to find the

wavelength of the wave, .....

m

amplitude of the wave. ....

m

[2]



**DATA SHEET**  
**The Periodic Table of the Elements**

		Group																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		I	II	III	IV	V	VI	VII	VIII	IX	X																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		1 <b>H</b> Hydrogen 1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
7	9	<b>Li</b> Lithium 3	<b>Be</b> Beryllium 4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
23	24	<b>Na</b> Sodium 11	<b>Mg</b> Magnesium 12																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
39	40	<b>K</b> Potassium 19	<b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
85	88	<b>Rb</b> Rubidium 37	<b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	101 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	128 <b>Te</b> Tellurium 52	131 <b>Xe</b> Xenon 54																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
133	137	<b>Cs</b> Caesium 55	<b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	210 <b>Rn</b> Radon 86																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
87	226	<b>Fr</b> Francium 87	<b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
												*58-71 Lanthanoid series †90-103 Actinoid series																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		a		X		b																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		Key		X		b																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		a = relative atomic mass		X = atomic symbol		b = proton (atomic) number																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
140	141	144	150	152	157	159	162	165	167	169	173	175	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.