

Surname	Centre Number	Candidate Number
First name(s)		0



**GCSE**

3440UA0-1



**WEDNESDAY, 15 JUNE 2022 – MORNING**

**APPLIED SCIENCE (Single Award)**

**UNIT 1: Science in the Modern World**

**HIGHER TIER**

1 hour 30 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	19	
2.	6	
3.	13	
4.	15	
5.	8	
6.	14	
<b>Total</b>	<b>75</b>	

**ADDITIONAL MATERIALS**

In addition to this paper you will require a calculator, pencil and a ruler.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

**INFORMATION FOR CANDIDATES**

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

Question 4(a)(i) is a quality of extended response (QER) question where your writing skills will be assessed.

You are reminded to show all your workings. Credit is given for correct workings even when the final answer given is incorrect.

A Periodic Table is printed on page 20.



JUN223440UA0101

Answer **all** questions.

1. Different techniques can be used to monitor the quality of water.

(a) Good river water quality is needed to support fish, vegetation, wetlands and birds.

The table below shows the results of tests carried out by students on two compounds, **A** and **B**, found in river water. The compounds were known to contain four of the following ions:

- sulfate
- calcium
- carbonate
- sodium
- chloride
- potassium
- iodide

Compound	Test used to identify positive ion		Test used to identify negative ion	
	Test using solid	Result	Test using solution	Result
<b>A</b>	Flame test	Lilac flame	Add dilute nitric acid followed by silver nitrate solution.	Yellow precipitate
<b>B</b>	Flame test	Brick red flame	Add dilute hydrochloric acid. Bubble gas through limewater.	Fizzing and limewater turns milky

Use the information in the table above to identify compounds **A** and **B**.

[4]

Compound **A**: .....

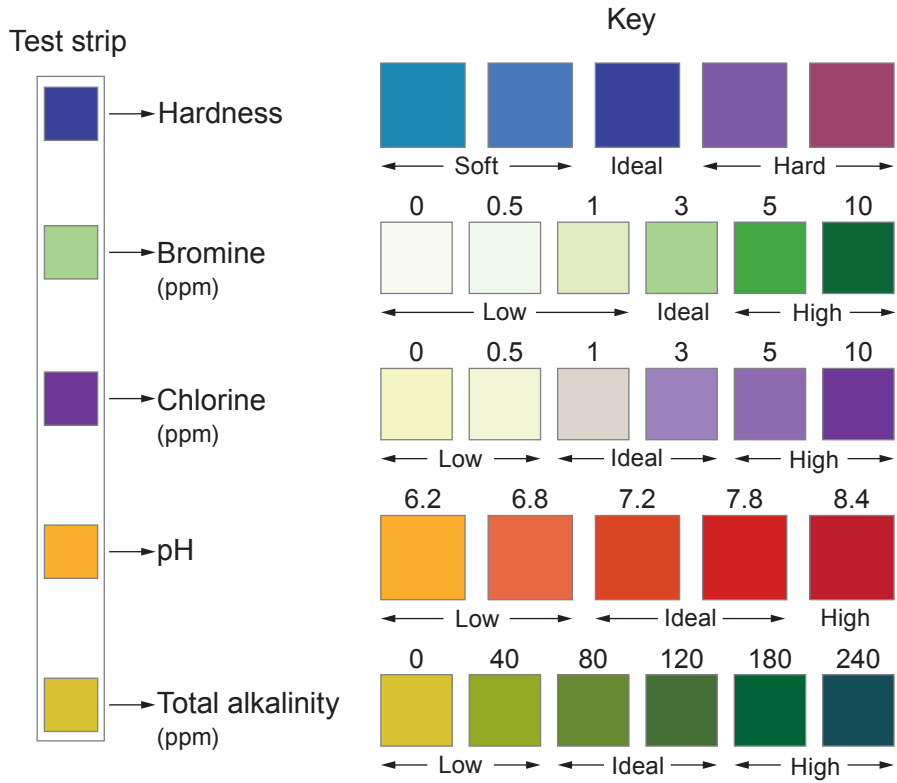
Compound **B**: .....



(b) Colour test strips can also be used to identify pollutants in water. They can also provide other information.

Ideal water quality in swimming pools and hot tubs is essential to prevent harm to people using them.

The colour test strip below has been produced from a swimming pool water sample. It is alongside a key.



One opinion suggests that it is safe for people to use the pool. Use the information above to explain whether you agree. [3]

.....

.....

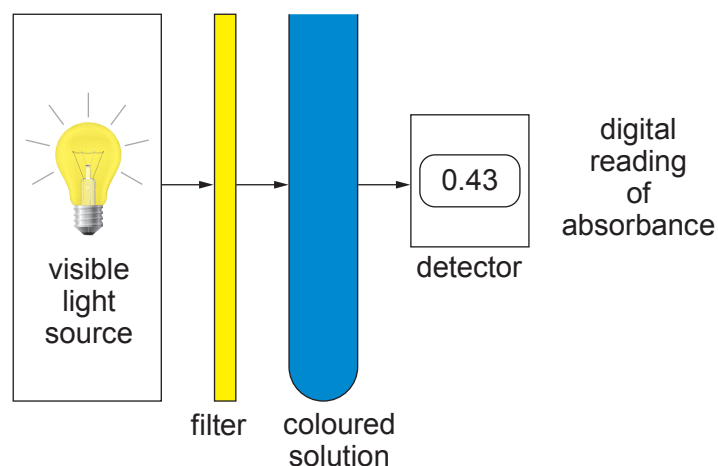
.....

.....

.....



- (c) Colorimetry is a method of determining the concentration of a substance in a solution by measuring the absorption of light. The instrument which is used to make these measurements is called a colorimeter. The diagram below shows how a colorimeter works.



Light is passed through a filter to select the most appropriate wavelength of light, some of which is then absorbed by the solution. The amount of light absorbed is measured and is called the absorbance.

A calibration graph using known concentrations of the tested solution is produced. The results of a calibration test using copper sulfate solutions of known concentrations are shown below.

Concentration (mol/dm <sup>3</sup> )	Absorbance (units)
0.00	0.00
0.01	0.11
0.02	0.22
0.05	0.55
0.06	0.66
0.08	0.88

- (i) Use the data to plot a graph on the grid opposite and draw a suitable line. [4]
- (ii) Describe the relationship between absorbance and the concentration of the solution. [2]

.....

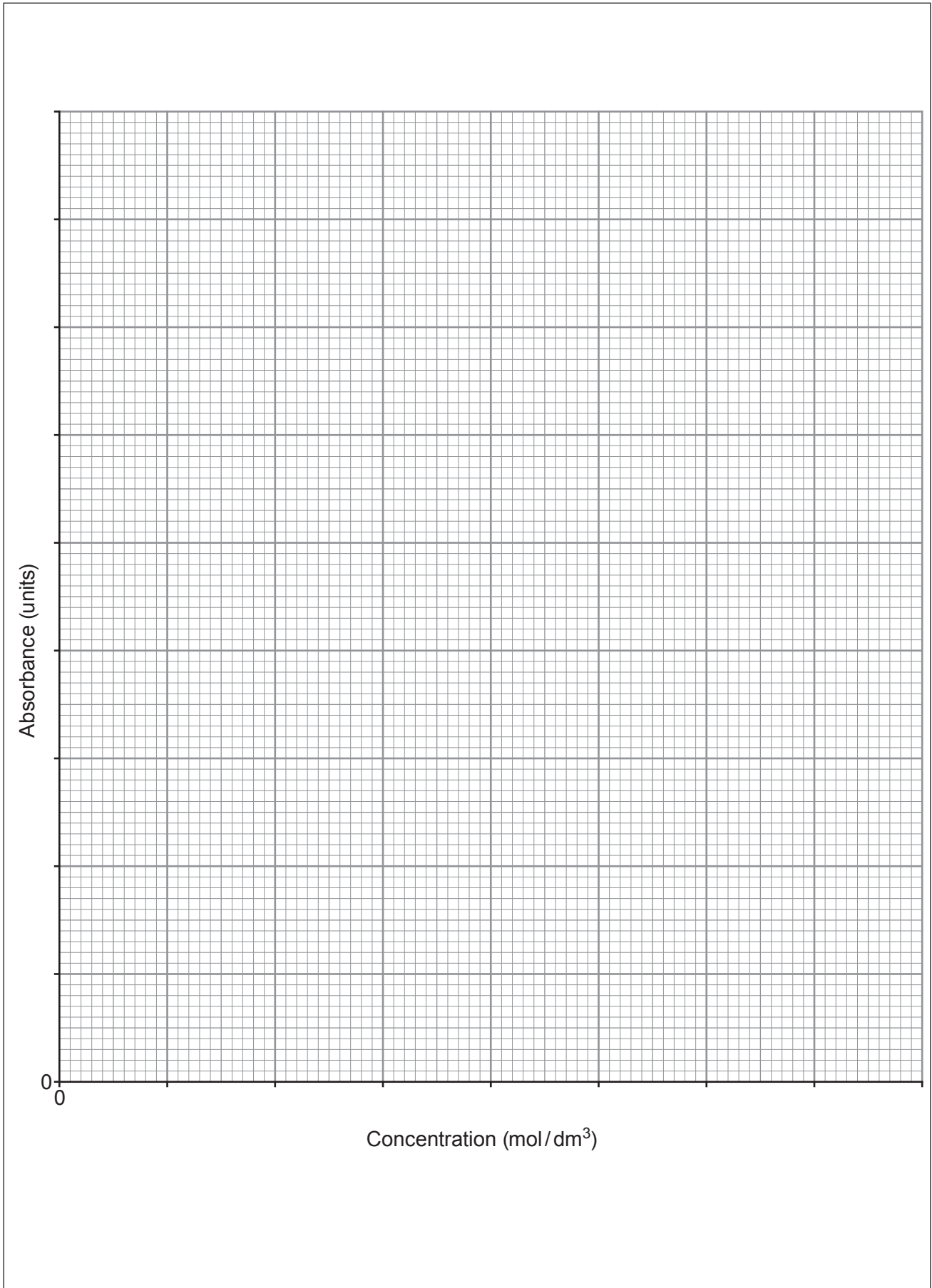
.....

.....

- (iii) A copper sulfate solution of unknown concentration was tested in the colorimeter and the absorbance was found to be 0.35 units. Use your graph to find the concentration of the solution. [1]

concentration = ..... mol/dm<sup>3</sup>





3440UA01  
05



- (iv) The filter used in the colorimeter is chosen to select the band of wavelengths which are most strongly absorbed by the coloured solution. When testing copper sulfate solution a yellow filter is used.

Wavelength band (nm)	Colour of the solution	Colour of the filter
400–435	violet	yellowish-green
435–480	blue	yellow
500–560	green	purple
580–595	yellow	blue
595–610	orange/brown	greenish-blue
610–750	red	bluish-green

- I. Iodine dissolved in potassium iodide solution is yellow at low concentrations and brown at higher concentrations. Explain how you would change the experiment to find the unknown concentration of iodine. [3]

.....

.....

.....

.....

.....

- II. Zinc sulfate solution is colourless. Explain whether the concentration of a zinc sulfate solution can be found by using coloured filters. [2]

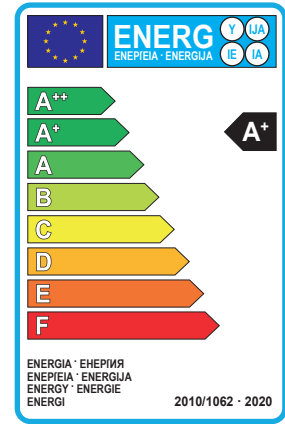
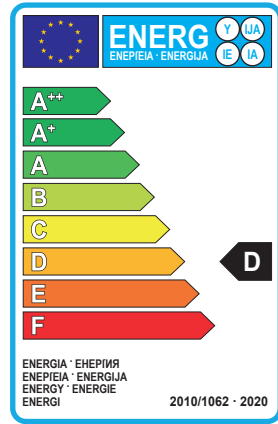
.....

.....

.....



2. Halogen lamps are rated D on energy performance certificates. They are being replaced by LED lamps which are rated A+ or A++.



- (a) A 230 V mains LED lamp operates on a current of 22 mA.

Use the equation

$$\text{power} = \text{voltage} \times \text{current}$$

to calculate the power of the lamp.

$$1 \text{ mA} = 10^{-3} \text{ A}$$

[3]

power = ..... W

- (b) LED lamps have efficiencies of 30%.  
The efficiency of halogen lamps is much lower however. A 42 W halogen lamp is only 5% efficient.

Use the equation

$$\% \text{ efficiency} = \frac{\text{power usefully transferred}}{\text{power supplied}} \times 100$$

to calculate the power usefully transferred by the halogen lamp.

[3]

useful power = ..... W



3. Energy is expensive so it is important that it is not wasted in homes.

(a) The table below shows the amount of heat energy lost through different parts of a house and how it depends on the temperature in the house. It shows how these values change as improvements are made. The values show how much energy is lost per **minute**.

Part of house	Type of insulation	Cost of insulation (£)	Energy lost per minute at the given house temperature (J/minute)		
			20°C	21°C	22°C
cavity walls	none		39900	43800	47600
	foam filled	1200	12700	14200	17300
windows	single glazed	1400	27700	29600	34800
	double glazed	2600	18800	21500	27900
loft	none		49700	58100	61300
	fibre glass	700	14300	15600	17500

Use the data in the table to answer the following questions.

(i) An advertising campaign claims that homeowners can save money and help the environment if they reduce the temperature inside their homes by 1°C. Explain whether you agree with these claims. [3]

.....

.....

.....

.....

.....

(ii) A homeowner spends money on installing loft insulation and cavity wall insulation. Previously, neither were present. Using the figures in the table, find the heat energy savings achieved each **second**, after these changes are made, if the homeowner maintains a temperature of 21°C in the home. [3]

heat energy savings = ..... J/s





- (iii) Use your answer to part (a)(ii) to calculate the power saving to the home in kW. [1]

power saving = ..... kW

- (b) A different homeowner insulates their house at a cost of £2400. They use a 32kW gas central heating system.  
Before the insulation was installed the gas system operated for 4 hours a day.  
Afterwards, it operated for 3.5 hours a day.

- (i) Use the equations:

units used (kWh) = power (kW) × time (h)

cost = units used × cost per unit

to calculate the money saved each **week** on the gas bill in **pence** after installing the insulation. [4]

(1 unit of gas costs 12p)

saving each week = ..... p

- (ii) Using the weekly saving you have found in part (b)(i), calculate how many weeks it would take to pay back the cost of the insulation for this house. [2]

payback time = ..... weeks





(iii) State the advantages and disadvantages of using ion exchange to soften water.

[3]

.....

.....

.....

.....

(b) Explain why ozone is added during water treatment.

[2]

.....

.....

.....

(c) Explain the role of microbes in the treatment of sewage.

[2]

.....

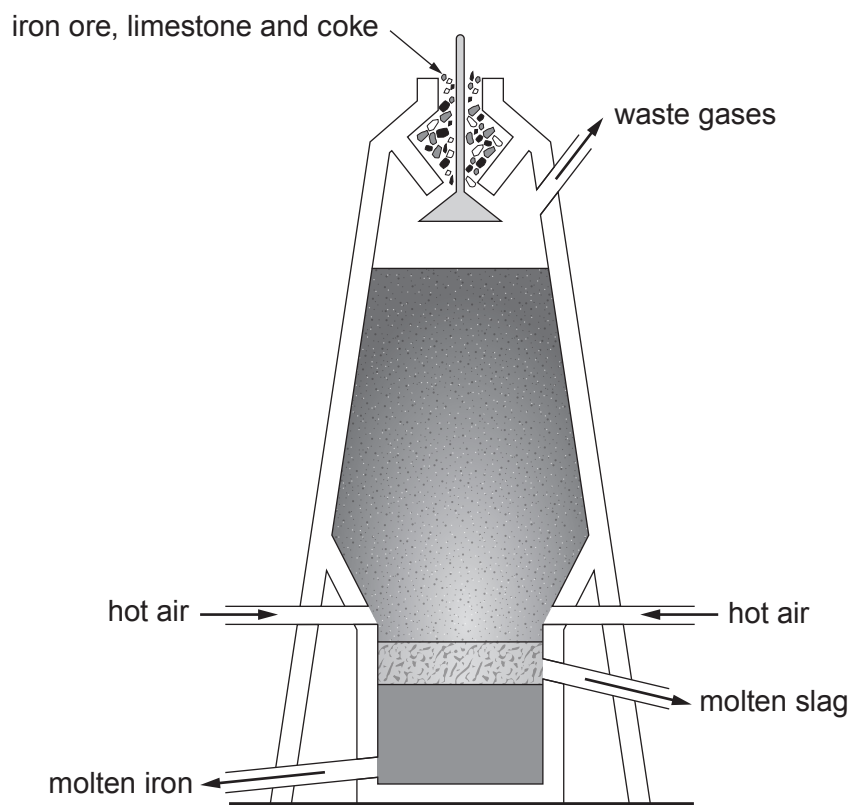
.....

.....

15



5. Iron is extracted from its ore in a blast furnace.

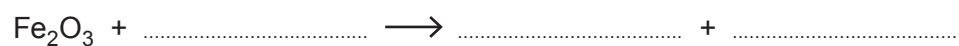


- (a) The word equation shows the reaction that forms iron.



Complete the balanced symbol equation for this reaction.

[3]



- (b) Explain why the lifetime of iron garden furniture is limited.

[2]

.....

.....

.....



(c) State the factors that make the production of iron from its ore so expensive.

[3]

Examiner  
only

.....

.....

.....

.....

.....

8



6. The Sun emits all of the different kinds of electromagnetic (em) radiation, but 99% of its energy is emitted in the form of visible light, ultraviolet light, and infrared rays.

- (a) All em waves transfer energy. The table below shows energy values in an **incorrect order**. Arrange the energy values in the **correct order**. [2]

Region	Energy (J) in incorrect order	Energy (J) in correct order
radio	$> 2 \times 10^{-14}$	.....
microwave	$3 \times 10^{-19}$ to $5 \times 10^{-19}$	.....
visible	$2 \times 10^{-17}$ to $2 \times 10^{-14}$	.....
X-ray	$2 \times 10^{-24}$ to $2 \times 10^{-22}$	.....
gamma ray	$< 2 \times 10^{-24}$	.....

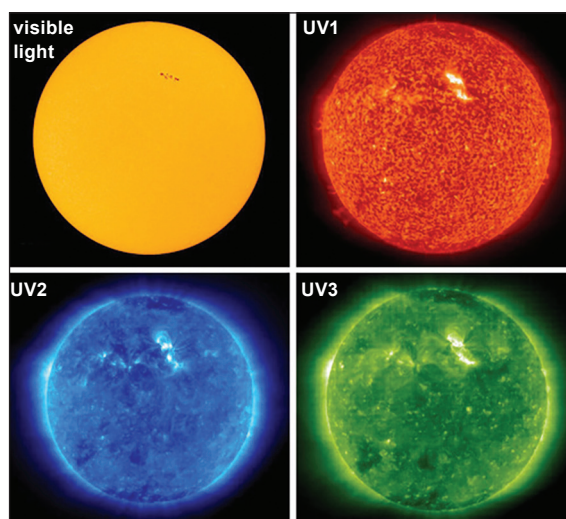
- (b) Photographs of the Sun are shown below. One is a visible light image and the others are ultraviolet (UV) images.

The wavelengths used to take the UV images are as follows:

UV1 = 30.4 nm

UV2 = 25.3 nm

UV3 = 19.5 nm



- (i) State which image is taken with the lowest frequency UV light. [1]

.....



(ii) Use the equation

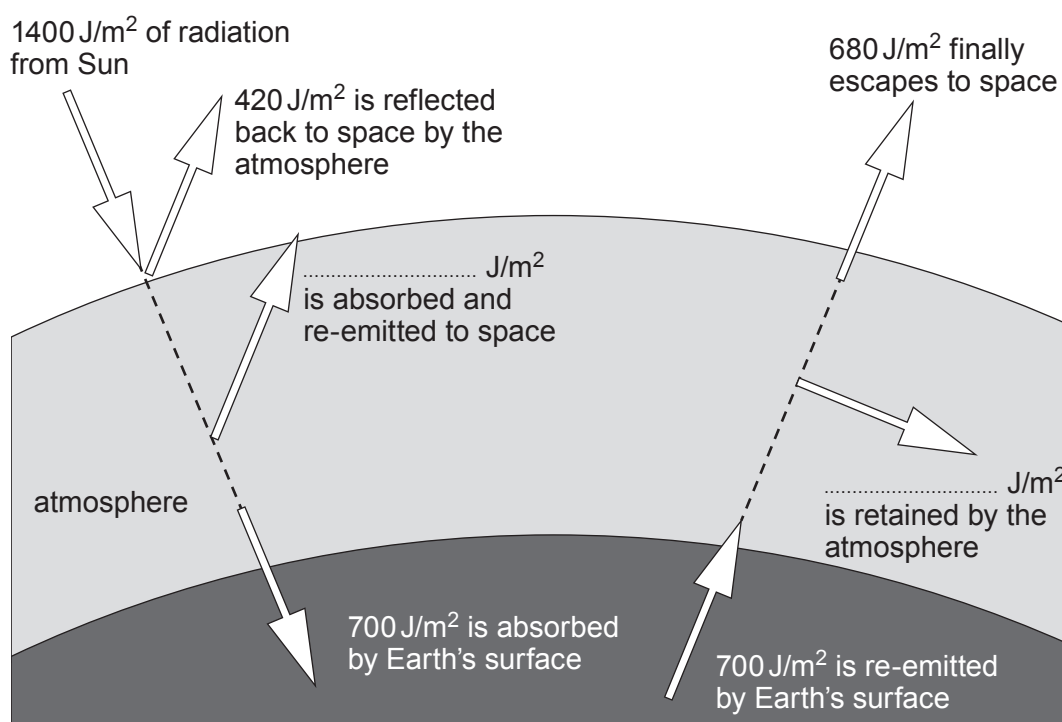
$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

to calculate the frequency used to take the lowest frequency UV image opposite and state the unit. [4]

(Speed of em waves in space =  $3 \times 10^8$  m/s;  $1 \text{ nm} = 10^{-9} \text{ m}$ )

frequency = ..... unit .....

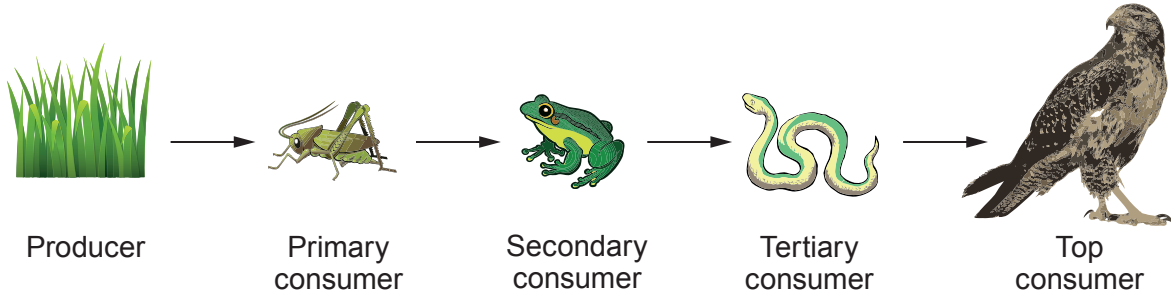
(c) Some of the energy from the Sun strikes the Earth. The diagram shows what happens to the energy falling on each  $\text{m}^2$  every second at one particular time.



(i) **Complete** the diagram by filling in the missing energy values. [2]



(ii) Radiation from the Sun is the source of energy for most ecosystems.



Explain how this energy is captured in the food chain shown and why there is a loss of energy at each stage of the chain. [3]

.....

.....

.....

.....

.....

(iii) As each consumer is killed by its predator for food, uneaten parts will decay releasing nitrates into the soil. Explain how plants use the nitrates in the soil. [2]

.....

.....

.....

END OF PAPER





**BLANK PAGE**

**PLEASE DO NOT WRITE  
ON THIS PAGE**









# THE PERIODIC TABLE

1      2      3      4      5      6      7      0

Group

7 Li Lithium 3	9 Be Beryllium 4	11 Na Sodium 11	12 C Carbon 6	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18	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	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	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 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54	55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64	65 Tb Terbium 65	66 Dy Dysprosium 66	67 Ho Holmium 67	68 Er Erbium 68	69 Tm Thulium 69	70 Yb Ytterbium 70	71 Lu Lutetium 71	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	104 Rf Rutherfordium 104	105 Db Dubnium 105	106 Sg Seaborgium 106	107 Bh Bohrium 107	108 Hs Hassium 108	109 Mt Meitnerium 109	110 Ds Darmstadtium 110	111 Rg Roentgenium 111	112 Cn Copernicium 112	113 Nh Nihonium 113	114 Fl Flerovium 114	115 Mc Moscovium 115	116 Lv Livermorium 116	117 Ts Tennessine 117	118 Og Oganesson 118	119 Uu Ununennium 119	120 Uub Unbibium 120	121 Uut Untrium 121	122 Uuq Unquadrium 122	123 Uuq Unquadrium 123	124 Uuq Unquadrium 124	125 Uuq Unquadrium 125	126 Uuq Unquadrium 126	127 Uuq Unquadrium 127	128 Uuq Unquadrium 128	129 Uuq Unquadrium 129	130 Uuq Unquadrium 130	131 Uuq Unquadrium 131	132 Uuq Unquadrium 132	133 Uuq Unquadrium 133	134 Uuq Unquadrium 134	135 Uuq Unquadrium 135	136 Uuq Unquadrium 136	137 Uuq Unquadrium 137	138 Uuq Unquadrium 138	139 Uuq Unquadrium 139	140 Uuq Unquadrium 140	141 Uuq Unquadrium 141	142 Uuq Unquadrium 142	143 Uuq Unquadrium 143	144 Uuq Unquadrium 144	145 Uuq Unquadrium 145	146 Uuq Unquadrium 146	147 Uuq Unquadrium 147	148 Uuq Unquadrium 148	149 Uuq Unquadrium 149	150 Uuq Unquadrium 150	151 Uuq Unquadrium 151	152 Uuq Unquadrium 152	153 Uuq Unquadrium 153	154 Uuq Unquadrium 154	155 Uuq Unquadrium 155	156 Uuq Unquadrium 156	157 Uuq Unquadrium 157	158 Uuq Unquadrium 158	159 Uuq Unquadrium 159	160 Uuq Unquadrium 160	161 Uuq Unquadrium 161	162 Uuq Unquadrium 162	163 Uuq Unquadrium 163	164 Uuq Unquadrium 164	165 Uuq Unquadrium 165	166 Uuq Unquadrium 166	167 Uuq Unquadrium 167	168 Uuq Unquadrium 168	169 Uuq Unquadrium 169	170 Uuq Unquadrium 170	171 Uuq Unquadrium 171	172 Uuq Unquadrium 172	173 Uuq Unquadrium 173	174 Uuq Unquadrium 174	175 Uuq Unquadrium 175	176 Uuq Unquadrium 176	177 Uuq Unquadrium 177	178 Uuq Unquadrium 178	179 Uuq Unquadrium 179	180 Uuq Unquadrium 180	181 Uuq Unquadrium 181	182 Uuq Unquadrium 182	183 Uuq Unquadrium 183	184 Uuq Unquadrium 184	185 Uuq Unquadrium 185	186 Uuq Unquadrium 186	187 Uuq Unquadrium 187	188 Uuq Unquadrium 188	189 Uuq Unquadrium 189	190 Uuq Unquadrium 190	191 Uuq Unquadrium 191	192 Uuq Unquadrium 192	193 Uuq Unquadrium 193	194 Uuq Unquadrium 194	195 Uuq Unquadrium 195	196 Uuq Unquadrium 196	197 Uuq Unquadrium 197	198 Uuq Unquadrium 198	199 Uuq Unquadrium 199	200 Uuq Unquadrium 200	201 Uuq Unquadrium 201	202 Uuq Unquadrium 202	203 Uuq Unquadrium 203	204 Uuq Unquadrium 204	205 Uuq Unquadrium 205	206 Uuq Unquadrium 206	207 Uuq Unquadrium 207	208 Uuq Unquadrium 208	209 Uuq Unquadrium 209	210 Uuq Unquadrium 210	211 Uuq Unquadrium 211	212 Uuq Unquadrium 212	213 Uuq Unquadrium 213	214 Uuq Unquadrium 214	215 Uuq Unquadrium 215	216 Uuq Unquadrium 216	217 Uuq Unquadrium 217	218 Uuq Unquadrium 218	219 Uuq Unquadrium 219	220 Uuq Unquadrium 220	221 Uuq Unquadrium 221	222 Uuq Unquadrium 222	223 Uuq Unquadrium 223	224 Uuq Unquadrium 224	225 Uuq Unquadrium 225	226 Uuq Unquadrium 226	227 Uuq Unquadrium 227	228 Uuq Unquadrium 228	229 Uuq Unquadrium 229	230 Uuq Unquadrium 230	231 Uuq Unquadrium 231	232 Uuq Unquadrium 232	233 Uuq Unquadrium 233	234 Uuq Unquadrium 234	235 Uuq Unquadrium 235	236 Uuq Unquadrium 236	237 Uuq Unquadrium 237	238 Uuq Unquadrium 238	239 Uuq Unquadrium 239	240 Uuq Unquadrium 240	241 Uuq Unquadrium 241	242 Uuq Unquadrium 242	243 Uuq Unquadrium 243	244 Uuq Unquadrium 244	245 Uuq Unquadrium 245	246 Uuq Unquadrium 246	247 Uuq Unquadrium 247	248 Uuq Unquadrium 248	249 Uuq Unquadrium 249	250 Uuq Unquadrium 250	251 Uuq Unquadrium 251	252 Uuq Unquadrium 252	253 Uuq Unquadrium 253	254 Uuq Unquadrium 254	255 Uuq Unquadrium 255	256 Uuq Unquadrium 256	257 Uuq Unquadrium 257	258 Uuq Unquadrium 258	259 Uuq Unquadrium 259	260 Uuq Unquadrium 260	261 Uuq Unquadrium 261	262 Uuq Unquadrium 262	263 Uuq Unquadrium 263	264 Uuq Unquadrium 264	265 Uuq Unquadrium 265	266 Uuq Unquadrium 266	267 Uuq Unquadrium 267	268 Uuq Unquadrium 268	269 Uuq Unquadrium 269	270 Uuq Unquadrium 270	271 Uuq Unquadrium 271	272 Uuq Unquadrium 272	273 Uuq Unquadrium 273	274 Uuq Unquadrium 274	275 Uuq Unquadrium 275	276 Uuq Unquadrium 276	277 Uuq Unquadrium 277	278 Uuq Unquadrium 278	279 Uuq Unquadrium 279	280 Uuq Unquadrium 280	281 Uuq Unquadrium 281	282 Uuq Unquadrium 282	283 Uuq Unquadrium 283	284 Uuq Unquadrium 284	285 Uuq Unquadrium 285	286 Uuq Unquadrium 286	287 Uuq Unquadrium 287	288 Uuq Unquadrium 288	289 Uuq Unquadrium 289	290 Uuq Unquadrium 290	291 Uuq Unquadrium 291	292 Uuq Unquadrium 292	293 Uuq Unquadrium 293	294 Uuq Unquadrium 294	295 Uuq Unquadrium 295	296 Uuq Unquadrium 296	297 Uuq Unquadrium 297	298 Uuq Unquadrium 298	299 Uuq Unquadrium 299	300 Uuq Unquadrium 300	301 Uuq Unquadrium 301	302 Uuq Unquadrium 302	303 Uuq Unquadrium 303	304 Uuq Unquadrium 304	305 Uuq Unquadrium 305	306 Uuq Unquadrium 306	307 Uuq Unquadrium 307	308 Uuq Unquadrium 308	309 Uuq Unquadrium 309	310 Uuq Unquadrium 310	311 Uuq Unquadrium 311	312 Uuq Unquadrium 312	313 Uuq Unquadrium 313	314 Uuq Unquadrium 314	315 Uuq Unquadrium 315	316 Uuq Unquadrium 316	317 Uuq Unquadrium 317	318 Uuq Unquadrium 318	319 Uuq Unquadrium 319	320 Uuq Unquadrium 320	321 Uuq Unquadrium 321	322 Uuq Unquadrium 322	323 Uuq Unquadrium 323	324 Uuq Unquadrium 324	325 Uuq Unquadrium 325	326 Uuq Unquadrium 326	327 Uuq Unquadrium 327	328 Uuq Unquadrium 328	329 Uuq Unquadrium 329	330 Uuq Unquadrium 330	331 Uuq Unquadrium 331	332 Uuq Unquadrium 332	333 Uuq Unquadrium 333	334 Uuq Unquadrium 334	335 Uuq Unquadrium 335	336 Uuq Unquadrium 336	337 Uuq Unquadrium 337	338 Uuq Unquadrium 338	339 Uuq Unquadrium 339	340 Uuq Unquadrium 340	341 Uuq Unquadrium 341	342 Uuq Unquadrium 342	343 Uuq Unquadrium 343	344 Uuq Unquadrium 344	345 Uuq Unquadrium 345	346 Uuq Unquadrium 346	347 Uuq Unquadrium 347	348 Uuq Unquadrium 348	349 Uuq Unquadrium 349	350 Uuq Unquadrium 350	351 Uuq Unquadrium 351	352 Uuq Unquadrium 352	353 Uuq Unquadrium 353	354 Uuq Unquadrium 354	355 Uuq Unquadrium 355	356 Uuq Unquadrium 356	357 Uuq Unquadrium 357	358 Uuq Unquadrium 358	359 Uuq Unquadrium 359	360 Uuq Unquadrium 360	361 Uuq Unquadrium 361	362 Uuq Unquadrium 362	363 Uuq Unquadrium 363	364 Uuq Unquadrium 364	365 Uuq Unquadrium 365	366 Uuq Unquadrium 366	367 Uuq Unquadrium 367	368 Uuq Unquadrium 368	369 Uuq Unquadrium 369	370 Uuq Unquadrium 370	371 Uuq Unquadrium 371	372 Uuq Unquadrium 372	373 Uuq Unquadrium 373	374 Uuq Unquadrium 374	375 Uuq Unquadrium 375	376 Uuq Unquadrium 376	377 Uuq Unquadrium 377	378 Uuq Unquadrium 378	379 Uuq Unquadrium 379	380 Uuq Unquadrium 380	381 Uuq Unquadrium 381	382 Uuq Unquadrium 382	383 Uuq Unquadrium 383	384 Uuq Unquadrium 384	385 Uuq Unquadrium 385	386 Uuq Unquadrium 386	387 Uuq Unquadrium 387	388 Uuq Unquadrium 388	389 Uuq Unquadrium 389	390 Uuq Unquadrium 390	391 Uuq Unquadrium 391	392 Uuq Unquadrium 392	393 Uuq Unquadrium 393	394 Uuq Unquadrium 394	395 Uuq Unquadrium 395	396 Uuq Unquadrium 396	397 Uuq Unquadrium 397	398 Uuq Unquadrium 398	399 Uuq Unquadrium 399	400 Uuq Unquadrium 400	401 Uuq Unquadrium 401	402 Uuq Unquadrium 402	403 Uuq Unquadrium 403	404 Uuq Unquadrium 404	405 Uuq Unquadrium 405	406 Uuq Unquadrium 406	407 Uuq Unquadrium 407	408 Uuq Unquadrium 408	409 Uuq Unquadrium 409	410 Uuq Unquadrium 410	411 Uuq Unquadrium 411	412 Uuq Unquadrium 412	413 Uuq Unquadrium 413	414 Uuq Unquadrium 414	415 Uuq Unquadrium 415	416 Uuq Unquadrium 416	417 Uuq Unquadrium 417	418 Uuq Unquadrium 418	419 Uuq Unquadrium 419	420 Uuq Unquadrium 420	421 Uuq Unquadrium 421	422 Uuq Unquadrium 422	423 Uuq Unquadrium 423	424 Uuq Unquadrium 424	425 Uuq Unquadrium 425	426 Uuq Unquadrium 426	427 Uuq Unquadrium 427	428 Uuq Unquadrium 428	429 Uuq Unquadrium 429	430 Uuq Unquadrium 430	431 Uuq Unquadrium 431	432 Uuq Unquadrium 432	433 Uuq Unquadrium 433	434 Uuq Unquadrium 434	435 Uuq Unquadrium 435	436 Uuq Unquadrium 436	437 Uuq Unquadrium 437	438 Uuq Unquadrium 438	439 Uuq Unquadrium 439	440 Uuq Unquadrium 440	441 Uuq Unquadrium 441	442 Uuq Unquadrium 442	443 Uuq Unquadrium 443	444 Uuq Unquadrium 444	445 Uuq Unquadrium 445	446 Uuq Unquadrium 446	447 Uuq Unquadrium 447	448 Uuq Unquadrium 448	449 Uuq Unquadrium 449	450 Uuq Unquadrium 450	451 Uuq Unquadrium 451	452 Uuq Unquadrium 452	453 Uuq Unquadrium 453	454 Uuq Unquadrium 454	455 Uuq Unquadrium 455	456 Uuq Unquadrium 456	457 Uuq Unquadrium 457	458 Uuq Unquadrium 458	459 Uuq Unquadrium 459	460 Uuq Unquadrium 460	461 Uuq Unquadrium 461	462 Uuq Unquadrium 462	463 Uuq Unquadrium 463	464 Uuq Unquadrium 464	465 Uuq Unquadrium 465	466 Uuq Unquadrium 466	467 Uuq Unquadrium 467	468 Uuq Unquadrium 468	469 Uuq Unquadrium 469	470 Uuq Unquadrium 470	471 Uuq Unquadrium 471	472 Uuq Unquadrium 472	473 Uuq Unquadrium 473	474 Uuq Unquadrium 474	475 Uuq Unquadrium 475	476 Uuq Unquadrium 476	477 Uuq Unquadrium 477	478 Uuq Unquadrium 478	479 Uuq Unquadrium 479	480 Uuq Unquadrium 480	481 Uuq Unquadrium 481	482 Uuq Unquadrium 482	483 Uuq Unquadrium 483	484 Uuq Unquadrium 484	485 Uuq Unquadrium 485	486 Uuq Unquadrium 486	487 Uuq Unquadrium 487	488 Uuq Unquadrium 488	489 Uuq Unquadrium 489	490 Uuq Unquadrium 490	491 Uuq Unquadrium 491	492 Uuq Unquadrium 492	493 Uuq Unquadrium 493	494 Uuq Unquadrium 494	495 Uuq Unquadrium 495	496 Uuq Unquadrium 496	497 Uuq Unquadrium 497	498 Uuq Unquadrium 498	499 Uuq Unquadrium 499	500 Uuq Unquadrium 500	501 Uuq Unquadrium 501	502 Uuq Unquadrium 502	503 Uuq Unquadrium 503	504 Uuq Unquadrium 504	505 Uuq Unquadrium 505	506 Uuq Unquadrium 506	507 Uuq Unquadrium 507	508 Uuq Unquadrium 508	509 Uuq Unquadrium 509	510 Uuq Unquadrium 510	511 Uuq Unquadrium 511	512 Uuq Unquadrium 512	513 Uuq Unquadrium 513	514 Uuq Unquadrium 514	515 Uuq Unquadrium 515	516 Uuq Unquadrium 516	517 Uuq Unquadrium 517	518 Uuq Unquadrium 518	519 Uuq Unquadrium 519	520 Uuq Unquadrium 520	521 Uuq Unquadrium 521	522 Uuq Unquadrium 522	523 Uuq Unquadrium 523	524 Uuq Unquadrium 524	525 Uuq Unquadrium 525	526 Uuq Unquadrium 526	527 Uuq Unquadrium 527	528 Uuq Unquadrium 528	529 Uuq Unquadrium 529	530 Uuq Unquadrium 530	531 Uuq Unquadrium 531	532 Uuq Un
-------------------------	---------------------------	--------------------------	------------------------	-----------------------------	---------------------------	-----------------------------	-------------------------	----------------------------	-------------------------	----------------------------	---------------------------	----------------------------	----------------------------	---------------------------	----------------------------	-----------------------------	------------------------	--------------------------	--------------------------	--------------------------	------------------------	---------------------------	-----------------------------	---------------------------	----------------------------	---------------------------	---------------------------	----------------------------	-----------------------------	--------------------------	-----------------------------	---------------------------	------------------------------	------------------------------	-----------------------------	---------------------------	-----------------------------	--------------------------	---------------------------	--------------------------	-----------------------	----------------------------	-----------------------------	-------------------------	-------------------------	---------------------------	--------------------------	-----------------------------	--------------------------	--------------------------------	-----------------------------	------------------------------	----------------------------	----------------------------	------------------------------	---------------------------	------------------------------	---------------------------	--------------------------	---------------------------	-----------------------------	----------------------------	---------------------------	----------------------------	---------------------------	---------------------------	--------------------------	---------------------------	----------------------------	------------------------	---------------------------	----------------------------	------------------------	---------------------------	----------------------------	----------------------------	-------------------------	----------------------------	--------------------------	----------------------------	---------------------------	--------------------------------	--------------------------	-----------------------------	-----------------------------	-----------------------------	--------------------------	-----------------------------	-------------------------------	-------------------------------	-----------------------------	---------------------------------	------------------------------	--------------------------------	-----------------------------------	-----------------------------	--------------------------------	-----------------------------	-----------------------------	--------------------------------	----------------------------------	---------------------------------	---------------------------------	------------------------------	-------------------------------	-------------------------------	---------------------------------	--------------------------------	-------------------------------	--------------------------------	-------------------------------	------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	------------------