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COMBINED SCIENCE

0653/32

Paper 3 Theory (Core)

February/March 2021

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].
- The Periodic Table is printed in the question paper.

This document has **24** pages. Any blank pages are indicated.

1 (a) Fig. 1.1 shows some of the organs of the human body.

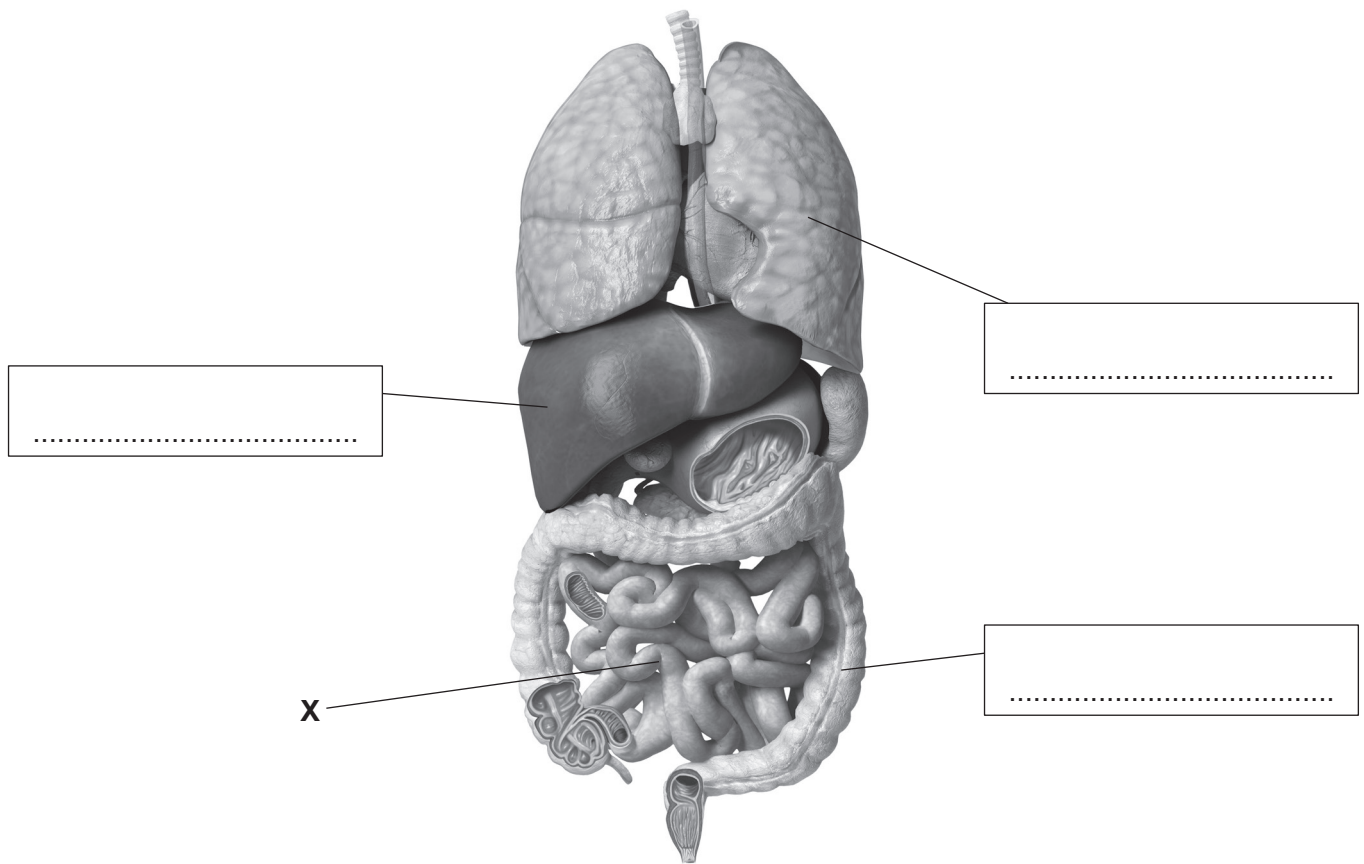


Fig. 1.1

(i) Complete the labels in Fig. 1.1 to show the names of the organs. [3]

(ii) One function of organ X is digestion.

State **one other** function of organ X.

..... [1]

(iii) Name the organ that pumps blood around the body.

..... [1]

(iv) Name the part of the body where egestion occurs.

..... [1]

(b) Enzymes are involved in digestion.

Fig. 1.2 is a graph that shows the effect of pH on the activity of three enzymes.

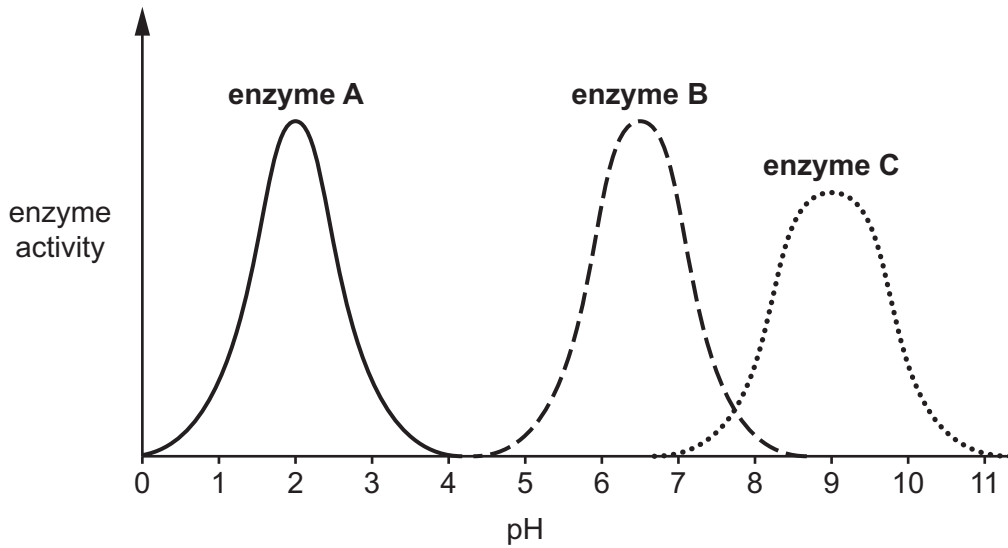


Fig. 1.2

(i) Describe the effect of pH on enzyme A.
Use data from the graph in your answer.

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

(ii) The mouth has an average pH of 6.7.
Identify which enzyme in Fig. 1.2 is found in the mouth.

Explain your answer.

enzyme

explanation

..... [2]

(iii) Enzymes are involved in the clotting of blood.

Circle the component of blood which is also involved in clotting.

plasma **platelets** **red blood cells** **white blood cells**

[1]

[Total: 11]

2 Natural gas and petroleum are two types of fossil fuel.

(a) Name **one** other fossil fuel.

..... [1]

(b) State the main constituent of natural gas.

..... [1]

(c) Petroleum is separated by the process shown in Fig. 2.1.

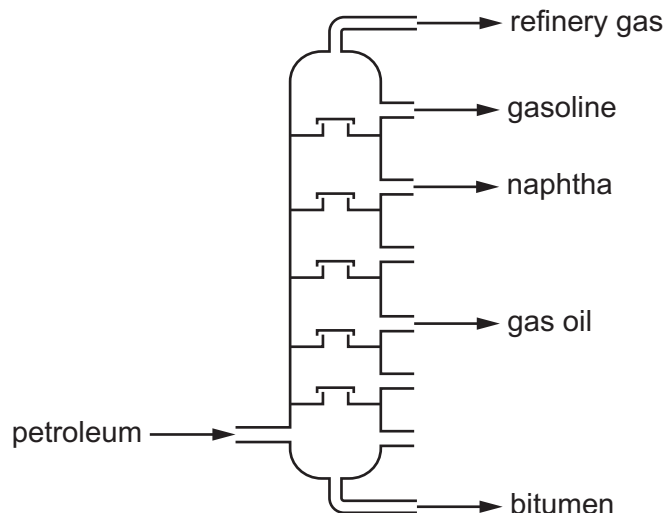


Fig. 2.1

(i) Name this process.

..... [1]

(ii) State **one** use for bitumen.

..... [1]

(d) Ethane and ethene are both hydrocarbons.

Ethane is an alkane.

Ethene is an alkene.

(i) Two compounds are made during the complete combustion of ethane and of ethene. Water is one of these compounds. Identify the **other** compound.

..... [1]

(ii) Describe **one** difference between molecules of ethane and molecules of ethene.

.....

..... [1]

(e) The structure of a molecule of another hydrocarbon is shown in Fig. 2.2.

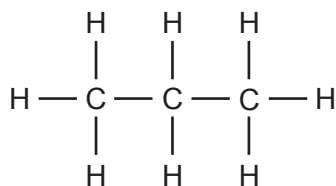


Fig. 2.2

Deduce the formula of this hydrocarbon.

..... [1]

[Total: 7]

3 Fig. 3.1 shows a car moving forward along a road. The road goes over a hill.



Fig. 3.1

Fig. 3.2 shows a speed–time graph for the car shown in Fig. 3.1.

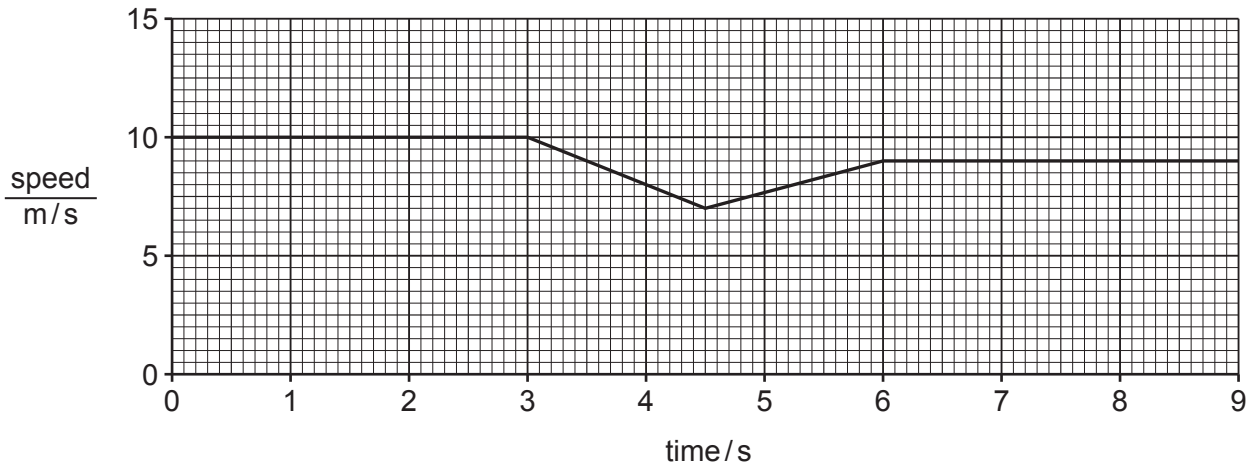


Fig. 3.2

(a) State the speed of the car before it reaches the hill.

..... m/s [1]

(b) (i) State what is meant by the term acceleration.

..... [1]

(ii) On Fig. 3.2 write an **X** at a point on the graph when the car is accelerating. [1]

(c) The journey shown in Fig. 3.2 is a total distance of 83 m.

Calculate the average speed of the car.

speed = m/s [2]

(d) Fig. 3.3 shows the car moving forward along a level road at a constant speed.

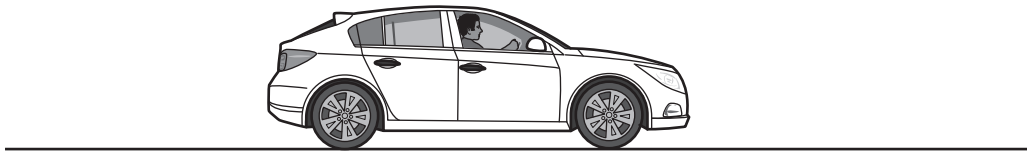


Fig. 3.3

(i) On Fig. 3.3 draw a force arrow to show the driving force acting on the car. [1]

(ii) Suggest why there has to be a driving force to keep the car moving at constant speed.

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

(e) The car engine uses gasoline (petrol) to do work to move the car along the road.

Complete the sentence below that describes the useful energy change as the car moves.

The gasoline provides energy that is changed into the energy of the moving car.

[2]

[Total: 9]

- 4 (a) The boxes on the left show parts of the male reproductive system. The boxes on the right show functions of these parts.

Draw one straight line from each part to its function.

name of part	function
scrotum	secretes fluids for sperm to swim in, forming semen
sperm duct	transfers sperm to the urethra
prostate gland	sac that holds the testes outside the body

[2]

- (b) Fig. 4.1 shows the female reproductive system.

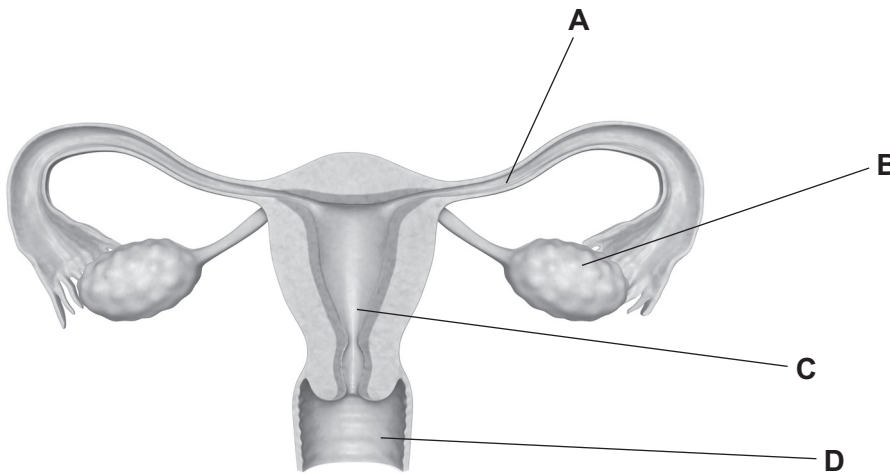


Fig. 4.1

Identify the letter **A**, **B**, **C** or **D** on Fig. 4.1 that shows:

where sperm is transferred by the penis during sexual intercourse

where the fetus develops.

[2]

(c) Female body temperature can change during the menstrual cycle.

Fig. 4.2 shows the body temperature of one female during her menstrual cycle.

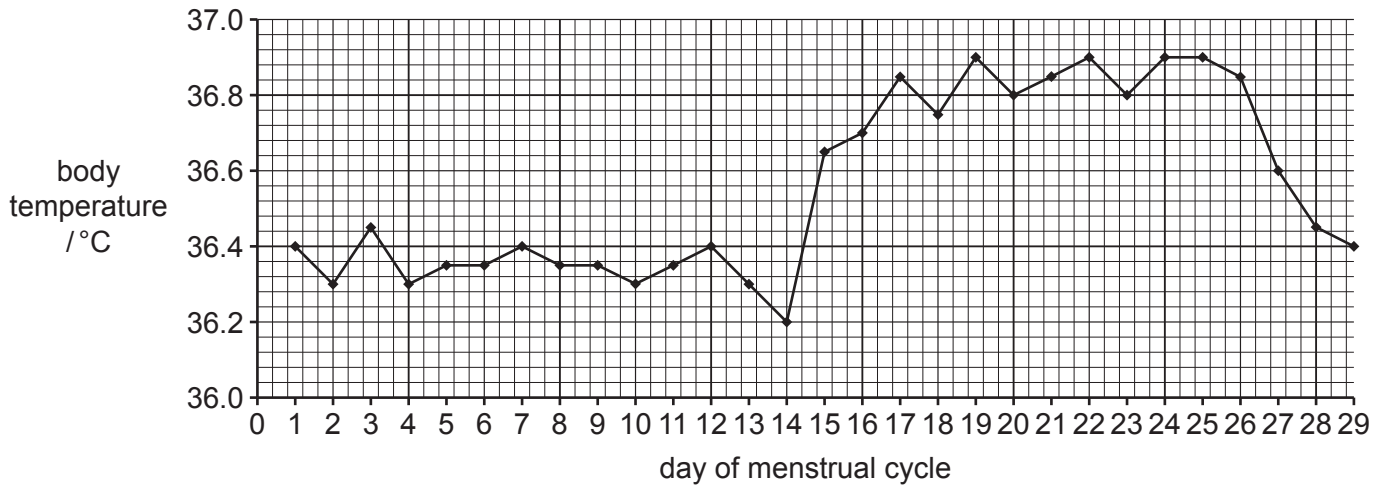


Fig. 4.2

This female releases an egg on day 14 of her menstrual cycle.

(i) Identify the body temperature of this female when she releases the egg.

..... °C [1]

(ii) Name the part of the female reproductive system that releases the egg.

..... [1]

(iii) Describe the body temperature of this female between day 25 and day 29.

.....
 [1]

(iv) Describe the changes that occur to the lining of the uterus between day 1 and day 5.

.....
 [1]

[Total: 8]

- 5 (a) An iron paperclip, shown in Fig. 5.1, is used to hold pieces of paper together.



Fig. 5.1

Iron can be described as a strong metal.

Name one **other** property of iron that makes it suitable for use as a paperclip.

..... [1]

- (b) A spanner, shown in Fig. 5.2, is made from an alloy of iron.

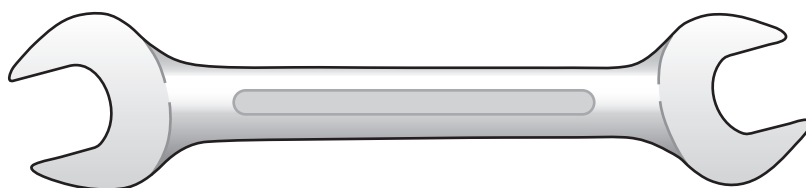


Fig. 5.2

- (i) Describe what is meant by an *alloy*.

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

- (ii) Suggest why the spanner is made from an alloy of iron and not from pure iron.

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

- (c) Lithium, sodium and potassium are Group I metals.
Describe the trend in density and the trend in reaction with water of the Group I metals going down the group.

density

.....

reaction with water

.....

[2]

(d) Copper and iron are part of a collection of metals in the Periodic Table.

(i) State the name of this collection of metals.

..... [1]

(ii) Copper and iron are less reactive than Group I metals.
Copper and iron have high melting points and high densities, but Group I metals do not.

State one **other** property of copper and iron that is **not** a property of Group I metals.

..... [1]

(e) When sodium reacts with chlorine, sodium chloride is formed.

Fig. 5.3 shows the electronic structures of a sodium atom and of a chlorine atom.



Fig. 5.3

Sodium chloride contains sodium ions and chloride ions.

Complete Fig. 5.4 to show the electronic structures of a sodium ion and a chloride ion.



Fig. 5.4

[2]

[Total: 9]

- 6 Fig. 6.1 shows a flask containing gas being heated in a water-bath. The water-bath is made of copper.
A U-tube containing water is connected to the flask.

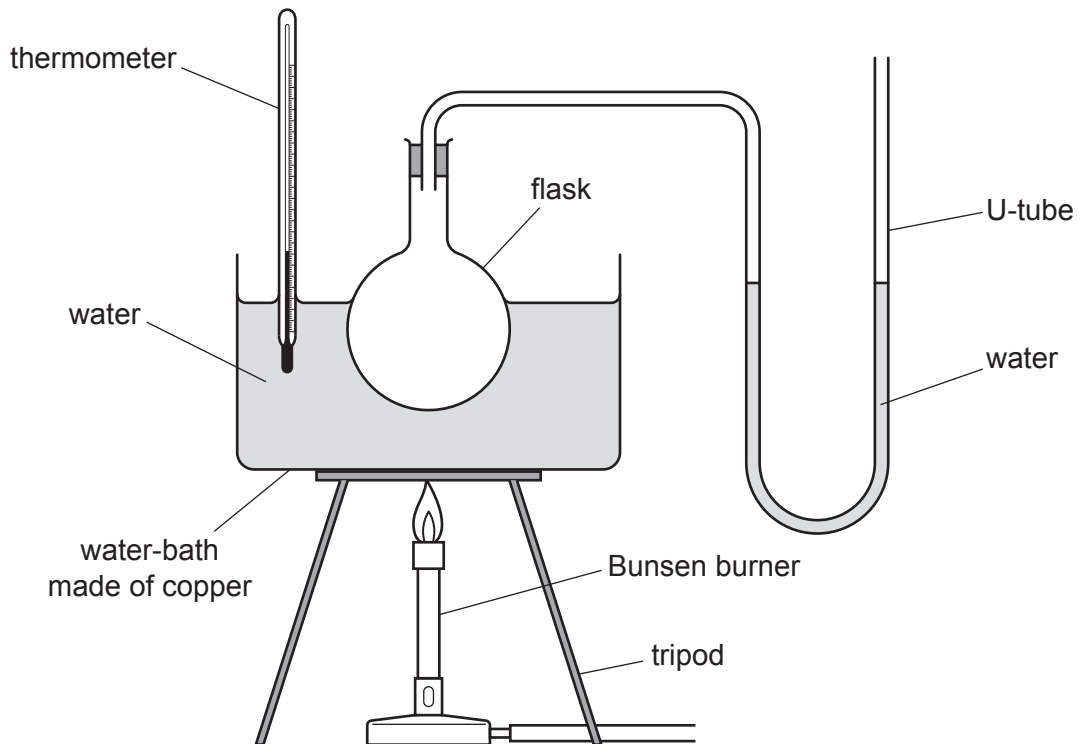


Fig. 6.1

- (a) As the water-bath is heated, the reading on the thermometer increases.
Name the processes by which thermal energy is transferred:

through the copper

.....

through the water.

.....

[2]

(b) The water in the U-tube is at the same level on each side when the water-bath is at 20 °C. As the temperature in the water-bath increases, the water levels in the U-tube change.

(i) Predict how the water levels in the U-tube look when the temperature has increased.

Draw your prediction on Fig. 6.2.

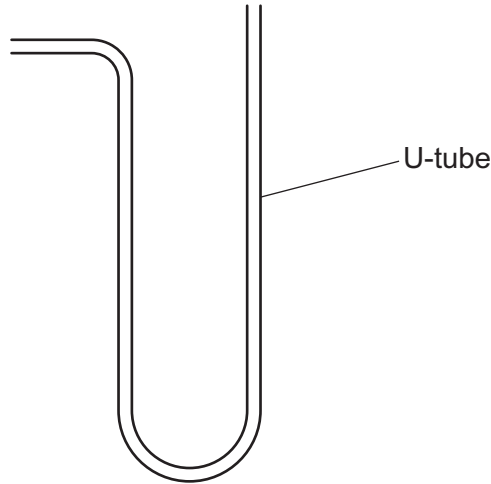


Fig. 6.2

[1]

(ii) Explain your prediction in terms of the motion and separation of the gas molecules inside the flask.

.....

.....

.....

..... [2]

(c) After a time the thermometer reads 100 °C. State what happens to the water in the water-bath at this temperature.

..... [1]

(d) The flame from the Bunsen burner is visible.

- (i) Fig. 6.3 shows an incomplete electromagnetic spectrum.
On Fig. 6.3 write visible light in its correct position on the electromagnetic spectrum.

gamma radiation		ultraviolet			microwaves	
-----------------	--	-------------	--	--	------------	--

Fig. 6.3

[1]

- (ii) The Bunsen burner also produces sound. Fig. 6.4 shows a diagram of the sound wave emitted by the Bunsen burner.

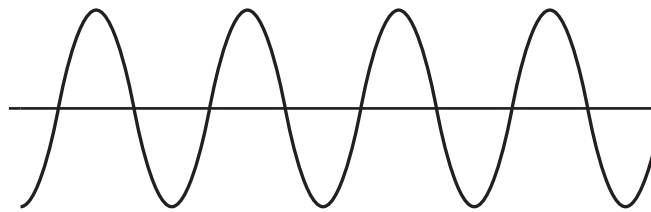


Fig. 6.4

Show clearly on Fig. 6.4 the wavelength of the sound wave. Label it **W**.

[1]

[Total: 8]

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7 (a) Fig. 7.1 shows part of a food web from a lake.

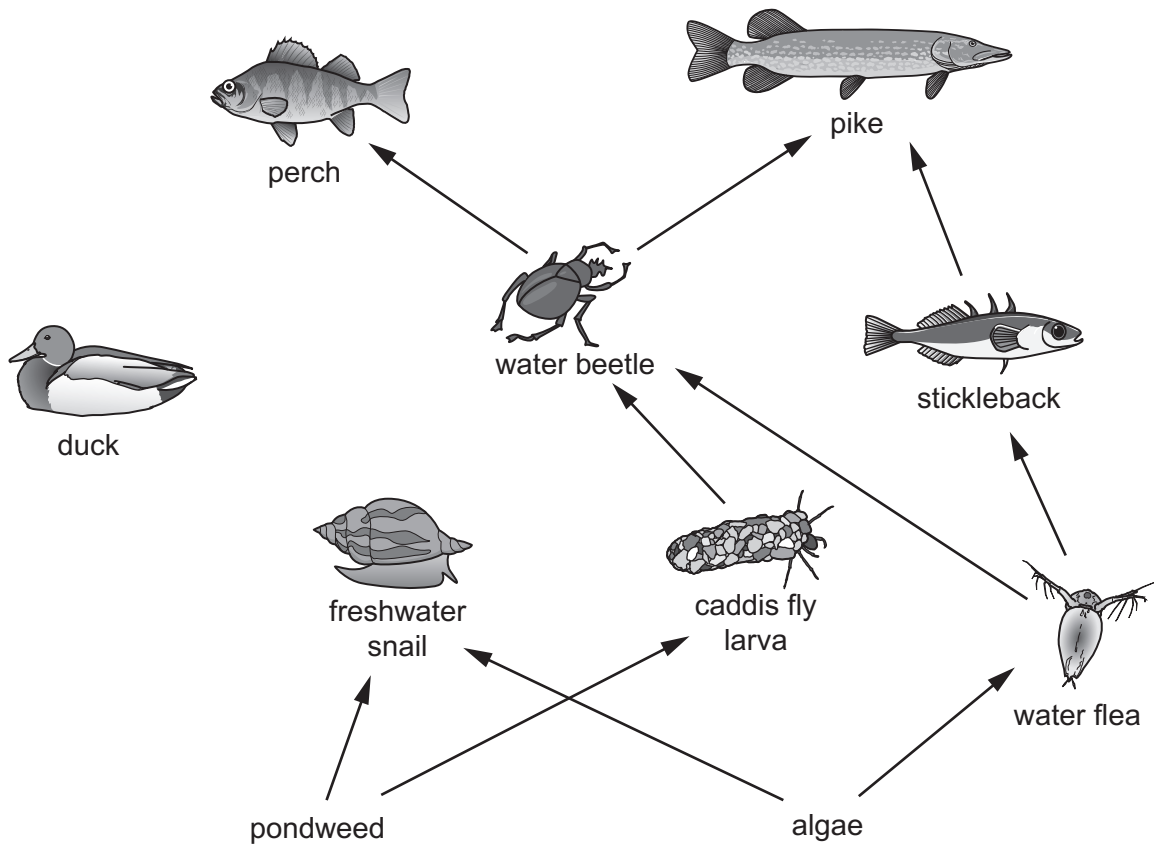


Fig. 7.1

(i) Identify **one** tertiary consumer shown in the food web in Fig. 7.1.

..... [1]

(ii) Identify **one** herbivore shown in the food web in Fig. 7.1.

..... [1]

(iii) The food web is **not** complete.

Ducks eat freshwater snails and pondweed.

Draw **two** arrows on Fig. 7.1 to complete the food web to include this information. [1]

(b) Pondweed can be used to investigate photosynthesis.

Fig. 7.2 shows how the gas made by the process of photosynthesis can be collected.

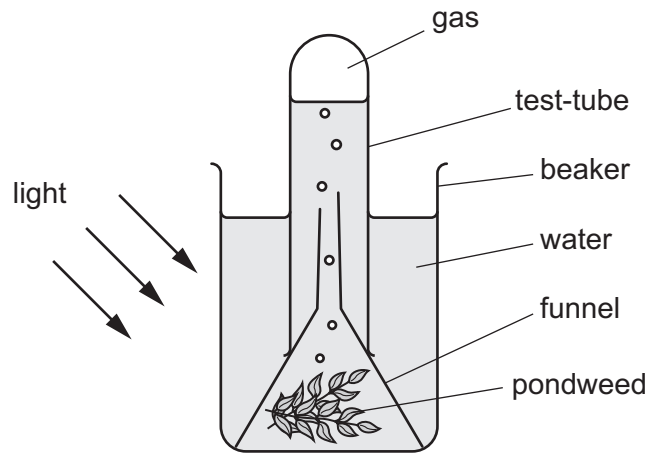


Fig. 7.2

(i) State the name of the gas that collects in the test-tube.

..... [1]

(ii) When the light is switched off the experiment in Fig. 7.2 is in the dark and the amount of gas being produced by the pondweed changes.

Suggest the change in the amount of gas being produced by the pondweed when the light is switched off.

Give a reason for your answer.

change in the amount of gas

reason

..... [2]

(c) Water is needed for the process of photosynthesis.

Name the vessels in the plant that transport water.

..... [1]

(d) Glucose is made by the process of photosynthesis.

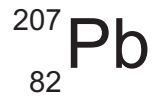
Plants use another process to release energy from glucose.

Name the process that releases energy from glucose.

..... [1]

[Total: 8]

8 (a) An atom of lead is represented by the symbol shown.



(i) Deduce the number of electrons and number of neutrons in this atom.

electrons

neutrons

[2]

(ii) The proton number (atomic number) of lead is 82.
Define the term proton number.

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

(iii) State the charges of protons, neutrons and electrons.

protons

neutrons

electrons

[1]

(b) Lead is extracted from molten lead(II) bromide using the apparatus shown in Fig. 8.1.

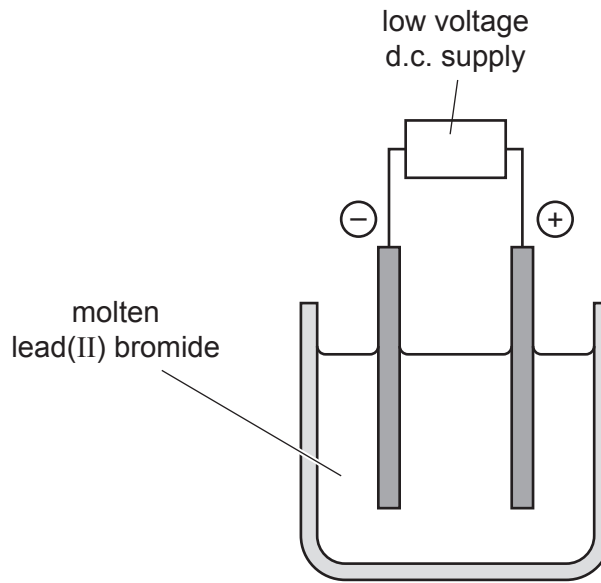


Fig. 8.1

(i) Name the process shown in Fig. 8.1.

..... [1]

(ii) State the name of the electrode at which lead forms.

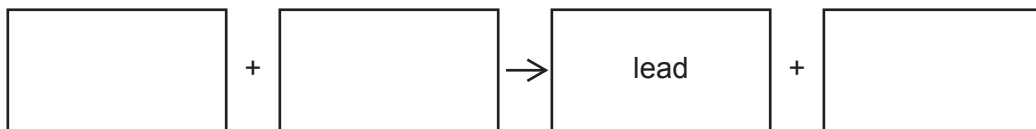
..... [1]

(c) Lead is extracted from lead(II) oxide, PbO, by heating with carbon. Carbon dioxide is also made in this endothermic reaction.

(i) Describe what is meant by an *endothermic* reaction.

.....
 [1]

(ii) Complete the word equation for this reaction.



[1]

(iii) Circle the word to show whether lead(II) oxide is oxidised or reduced in this reaction. Explain your answer.

oxidised **reduced**

explanation

.....

[1]

(d) A teacher has a **different** compound of lead.

When this compound of lead reacts with dilute hydrochloric acid, carbon dioxide is formed.

Suggest the name of this compound of lead.

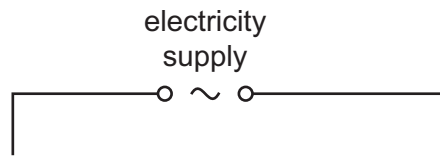
..... [1]

[Total: 10]

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- 9 (a) Two identical street lamps are connected in parallel to the mains electricity supply. Each lamp has its own switch.

(i) Complete the circuit diagram for these lamps.



[3]

- (ii) The voltage of the electricity supply is 220V. The current flowing in one lamp when lit is 0.40A.

Calculate the resistance of one lamp.
State the unit of your answer.

resistance = unit [3]

- (iii) Circle the correct value for the current from the electricity supply when both lamps are lit.

Give a reason for your answer.

0.2 A **0.4 A** **0.8 A**

reason

.....

[1]

- (b) Fig. 9.1 shows a street lamp seen by a car driver looking at the reflection in the car mirror.

Draw a ray diagram to show how a light ray from the lamp is reflected to the driver's eye. Your drawing should include the normal at the mirror.



Fig. 9.1

[3]

[Total: 10]

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The Periodic Table of Elements

		Group																	
I	II	III	IV	V	VI	VII	VIII												
3 Li lithium 7	4 Be beryllium 9	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20												
11 Na sodium 23	12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40												
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84		
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131		
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —		
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —						

1
H
hydrogen
1

Key
atomic number
atomic symbol
name
relative atomic mass

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).