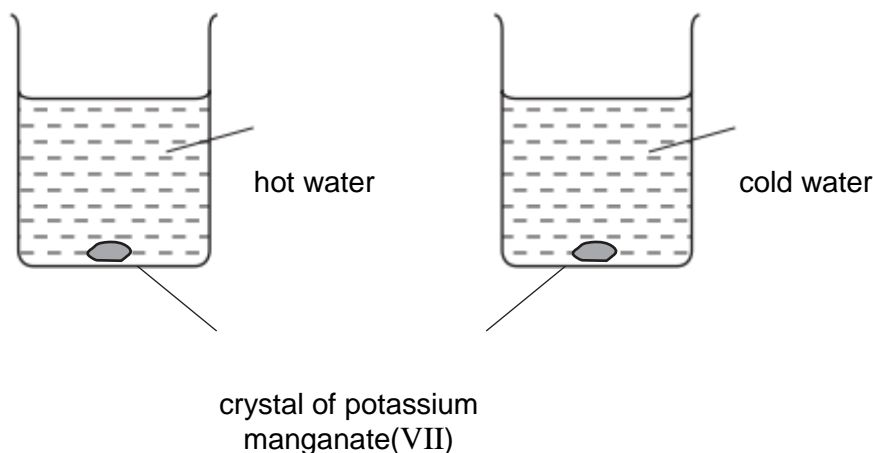


- 1 A crystal of purple potassium manganate (VII) was added to each of the beakers shown in the diagram.



One beaker contained hot water and the other beaker contained cold water.

In both beakers the purple colour of the potassium manganate(VII) spreads out.

Which result and explanation are correct?

	result	explanation
A	colour spreads faster in cold water	particles move faster at a higher temperature
B	colour spreads faster in cold water	particles move slower at a higher temperature
C	colour spreads faster in hot water	particles move faster at a higher temperature
D	colour spreads faster in hot water	particles move slower at a higher temperature

[1]

- 2 During a reaction, the following changes take place.

- 1 The temperature rises.
- 2 A gas is given off.

Which apparatus is required to measure the rate of this reaction?

- A balance and burette
- B balance and gas syringe
- C gas syringe and burette
- D gas syringe and stopclock

[1]

- 3 Which statement about bonding is not correct?

- A Carbon can form four single covalent bonds.
- B Chlorine atoms react to gain a noble gas electronic structure.
- C Covalent bonding involves losing and gaining electrons.
- D Hydrogen molecules have the formula H_2 .

[1]

4 The table shows the numbers of particles present in the nuclei of four atoms or ions.

	protons	neutrons	electronic structure
1	18	22	2,8,8
2	19	20	2,8,8
3	19	21	2,8,8,1
4	20	20	2,8,8,2

Which two particles belong to the same element?

- A 1 and 2 B 1 and 4 C 2 and 3 D 2 and 4

[1]

5 Which substance is an ionic compound?

	volatility	electrical conductivity when molten	solubility in water
A	high	good	soluble
B	high	poor	insoluble
C	low	good	soluble
D	low	poor	insoluble

[1]

6 Covalent bonds are formed when electrons are1..... .

Most covalent compounds have2..... electrical conductivity.

Which words correctly complete gaps 1 and 2?

	1	2
A	shared	high
B	shared	low
C	transferred	high
D	transferred	low

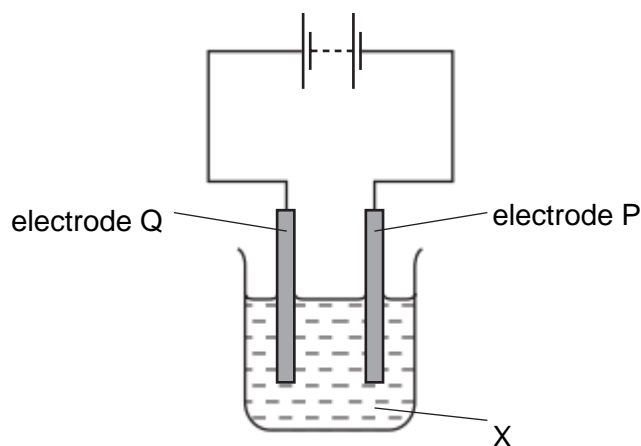
[1]

7 Which equation for the reaction between sodium carbonate and dilute hydrochloric acid is correct?

- A $\text{Na}_2\text{CO}_3(\text{s}) + \text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
 B $\text{Na}_2\text{CO}_3(\text{s}) + \text{HCl}(\text{aq}) \rightarrow \text{Na}_2\text{Cl}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
 C $\text{Na}_2\text{CO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
 D $\text{Na}_2\text{CO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$

[1]

8 The diagram shows an electrolysis experiment.



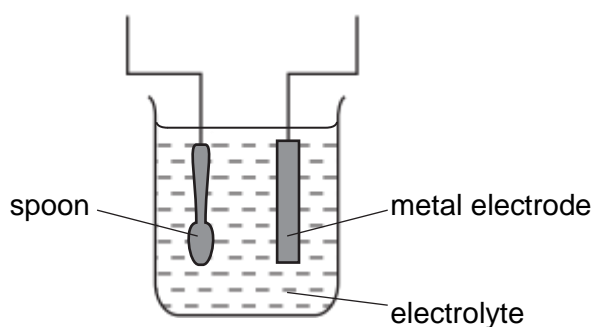
During the electrolysis, sodium was formed at electrode P and chlorine at electrode Q.

Which row correctly identifies P, Q and X?

	P	Q	X
A	anode	cathode	concentrated solution of sodium chloride in water
B	anode	cathode	molten sodium chloride
C	cathode	anode	concentrated solution of sodium chloride in water
D	cathode	anode	molten sodium chloride

[1]

9 The diagram shows apparatus for plating a spoon with silver.



Which statement is not correct?

- A Silver would stick to the spoon because it is a very reactive metal.
- B The electrolyte would be a silver salt dissolved in water.
- C The metal electrode would be made from silver.
- D The spoon would be connected to the negative terminal of the power supply.

[1]

10 Limestone can be changed into slaked lime in two chemical reactions.

- 1 When limestone, CaCO_3 , is heated it decomposes into lime, CaO .
- 2 Water is slowly dripped onto the cooled lime. The lime appears to expand and steam is produced. Slaked lime, Ca(OH)_2 , is formed.

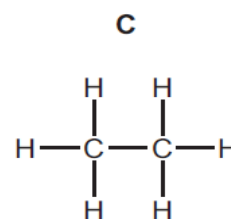
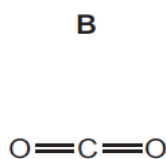
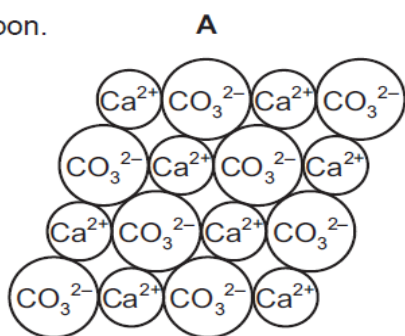
Which row shows the correct description of each of the chemical reactions?

	reaction 1	reaction 2
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

[1]

11 The diagram shows the structures of some substances containing

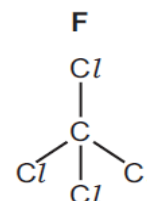
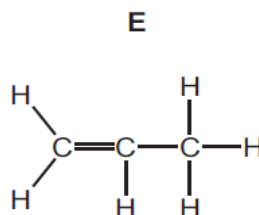
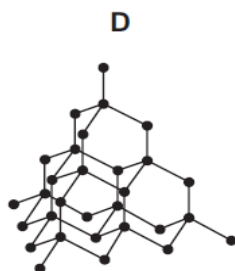
carbon.



(iv)

(v)

(b)



Answer the following questions about these substances.

Each substance may be used once, more than once or not at all.

(a) Which substance, A, B, C, D, E or F

- (i) is a saturated hydrocarbon,
- (ii) has an ionic structure,
- (iii) is a product of respiration,
- is in the same homologous series as methane,
- is used for cutting?

[5]

Substance D is an element.

Explain why substance D is an element.

..... [1]

[Total: 6]

Some properties of the halogens are shown in the table.

halogen	boiling point /°C	state at room temperature and pressure
fluorine	-188	
chlorine	-35	gas
bromine	+59	liquid
iodine	+184	solid
astatine		solid

(a) Use the information in the table to deduce

(i) the boiling point of astatine,

..... [1]

(ii) the state of fluorine at room temperature and pressure.

..... [1]

(b)

When chlorine reacts with aqueous potassium iodide, the solution turns brown.

(i) Write a word equation for this reaction.

..... [2]

(ii) Explain why iodine does not react with aqueous potassium chloride.

..... [1]

(c) When sodium reacts with iodine, energy is released.

(i) What is the name given to a reaction which releases energy?

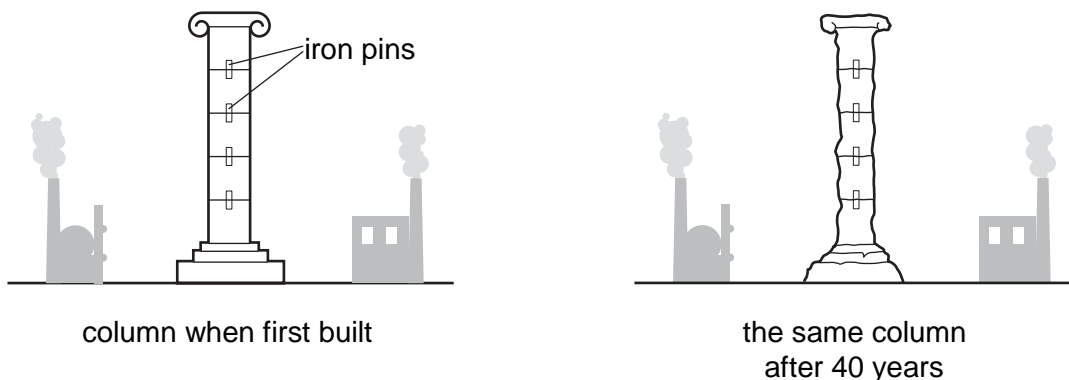
(ii) [1]

Explain what happens in terms of electron transfer when a sodium atom reacts with an iodine atom.

..... [2]

[Total: 8]

13The diagram shows a limestone column in an industrial town. Limestone is largely calcium carbonate.



(a) Describe and explain the changes to the column over 40 years.

In your answer refer to

- the change to the limestone,
- the name of a pollutant causing this change,
- the chemistry involved in this change.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The sections of the column are joined with iron pins which rust when exposed to the atmosphere. Describe two methods of rust prevention and explain how they prevent rusting.

.....

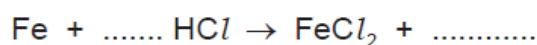
.....

.....

..... [3]

(d) Iron reacts with hydrochloric acid to form iron(II) chloride and a gas which 'pops' with a lighted splint.

Complete the symbol equation for this reaction.



[2]

[Total: 9]

DATA SHEET
The Periodic Table of the Elements

		Group																																		
		I	II	III	IV	V	VI	VII	0																											
7	Li Lithium 3	9	Be Beryllium 4	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>1</td> <td>H Hydrogen 1</td> </tr> <tr> <td>4</td> <td>He Helium 2</td> </tr> </table>										1	H Hydrogen 1	4	He Helium 2	20	Ne Neon 10																	
1	H Hydrogen 1																																			
4	He Helium 2																																			
23	Na Sodium 11	24	Mg Magnesium 12	11	B Boron 5	12	C Carbon 6	14	N Nitrogen 7	16	O Oxygen 8	19	F Fluorine 9	35.5	Cl Chlorine 17	40	Ar Argon 18																			
39	K Potassium 19	40	Ca Calcium 20	45	Sc Scandium 21	48	Ti Titanium 22	51	V Vanadium 23	52	Cr Chromium 24	55	Mn Manganese 25	56	Fe Iron 26	59	Co Cobalt 27	59	Ni Nickel 28	64	Cu Copper 29	65	Zn Zinc 30	70	Ga Gallium 31	73	Ge Germanium 32	75	As Arsenic 33	79	Se Selenium 34	80	Br Bromine 35	84	Kr Krypton 36	
85	Rb Rubidium 37	88	Sr Strontium 38	89	Y Yttrium 39	91	Zr Zirconium 40	93	Nb Niobium 41	96	Mo Molybdenum 42	101	Ru Ruthenium 44	106	Pd Palladium 46	108	Ag Silver 47	112	Cd Cadmium 48	115	In Indium 49	119	Sn Tin 50	122	Sb Antimony 51	128	Te Tellurium 52	131	Xe Xenon 54							
133	Cs Caesium 55	137	Ba Barium 56	139	La Lanthanum 57	178	Hf Hafnium 72	181	Ta Tantalum 73	184	W Tungsten 74	186	Re Rhenium 75	190	Os Osmium 76	192	Ir Iridium 77	195	Pt Platinum 78	201	Hg Mercury 80	204	Tl Thallium 81	207	Pb Lead 82	209	Bi Bismuth 83	212	Po Polonium 84	210	At Astatine 85	210	Rn Radon 86			
	Fr Francium 87	226	Ra Radium 88	227	Ac Actinium 89																															

* 58-71 Lanthanoid series
† 90-103 Actinoid series

a	X	a = relative atomic mass
b	X	X = atomic symbol
		b = proton (atomic) number

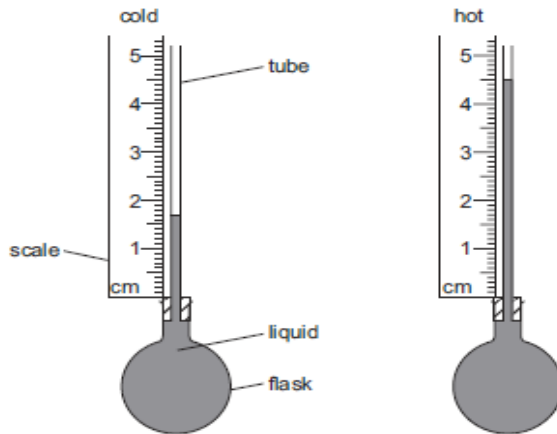
140	Ce Cerium 58	141	Pr Praseodymium 59	144	Nd Neodymium 60	150	Sm Samarium 62	152	Eu Europium 63	157	Gd Gadolinium 64	162	Dy Dysprosium 66	165	Ho Holmium 67	167	Er Erbium 68	169	Tm Thulium 69	173	Yb Ytterbium 70	175	Lu Lutetium 71
232	Th Thorium 90		Pa Protactinium 91	238	U Uranium 92		Pu Plutonium 94		Am Americium 95		Cm Curium 96		Cf Californium 98		Es Einsteinium 99		Fm Fermium 100		Md Mendelevium 101		No Nobelium 102		Lr Lawrencium 103

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

Physics

- 1 Some liquid is heated in a flask.

The diagrams show the height of the liquid in the tube when the liquid is cold and when it is hot.



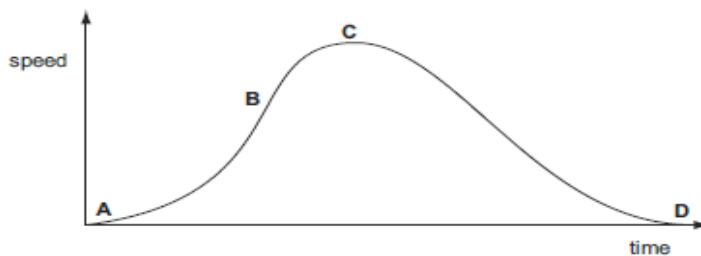
What is the difference in the heights?

- A 1.7 cm B 2.8 cm C 3.2 cm D 4.5 cm

[1]

- 2 The speed-time graph shown is for a bus travelling between stops.

Where on the graph is the acceleration of the bus the greatest?



[1]

- 3 In a race, a car travels 60 times around a 3.6km track. This takes 2.4 hours.

What is the average speed of the car?

- A 1.5 km/h B 90 km/h C 144 km/h D 216 km/h

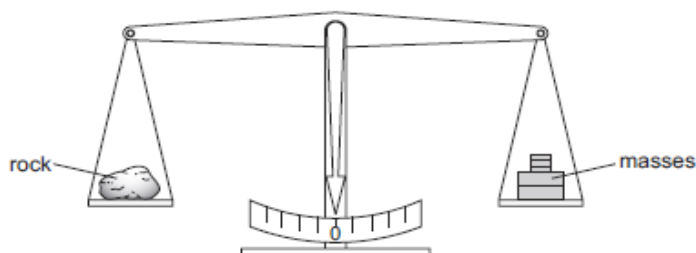
[1]

- 4 Which quantity is measured in newtons?

- A density
B energy
C pressure
D weight

[1]

- 5 A geologist places a small rock on the left-hand pan of a balance. The two pans are level as shown when masses with a total weight of 23N are placed on the right-hand pan. Take the weight of 1.0 kg to be 10N.

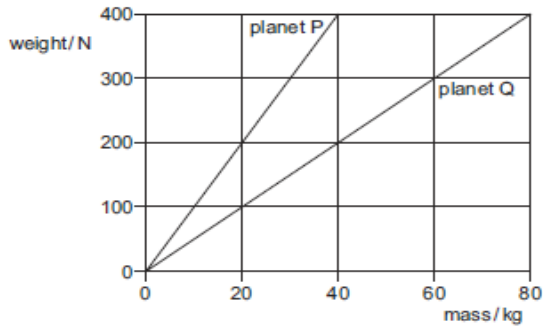


What is the mass of the small rock?

- A 0.023 kg B 2.3 kg C 23 kg D 230 kg

[1]

- 6 The graph shows how weight varies with mass on planet P and on planet Q.



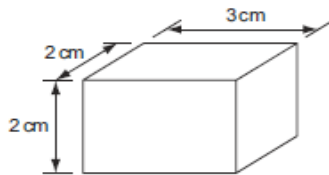
An object weighs 400 N on planet P. The object is taken to planet Q.

Which row is correct?

	mass of object on planet Q / kg	weight of object on planet Q / N
A	40	200
B	40	400
C	80	200
D	80	400

[1]

- 7 The diagram shows a rectangular block of density 2 g/cm^3 .

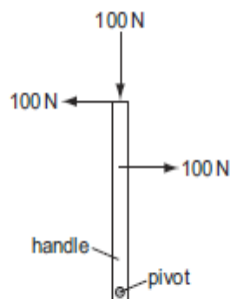


What is the mass of the block?

- A** 2g **B** 6g **C** 14g **D** 24g

[1]

- 8 The diagram shows a handle with three forces, each 100 N, applied to it. The handle is free to move.



What is the effect of the forces on the handle?

- A** The handle will move downwards.
B The handle will not move.
C The handle will turn anticlockwise (to the left).
D The handle will turn clockwise (to the right).

[1]

- 9 In which pair of energy sources are both sources renewable?

- A** oil and coal
B oil and tidal
C tidal and geothermal
D tidal and nuclear fission

[1]

10 Energy is stored in a battery and in a box of matches.

Which type of energy is stored in each of them?

	a battery	a box of matches
A	chemical	chemical
B	chemical	internal (thermal)
C	electrical	chemical
D	electrical	internal (thermal)

[1]

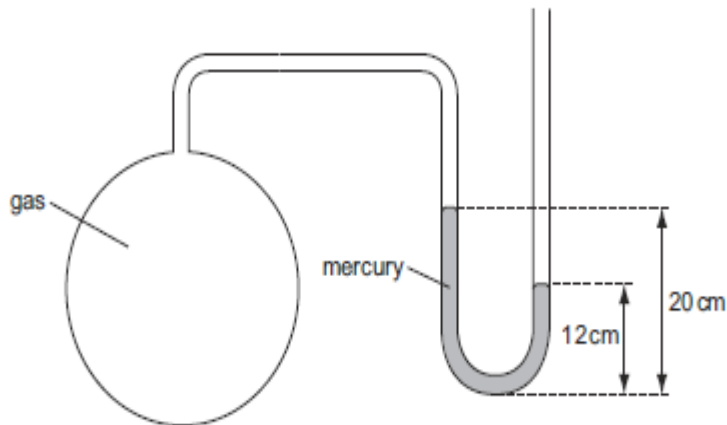
11 A man lifts 20 bricks, each of weight 6N.

What other information is needed to calculate the useful work done in lifting the bricks?

- A the distance he lifts the bricks
- B the mass of the bricks
- C the time taken to lift the bricks
- D the volume of the bricks

[1]

12 The diagram shows a mercury manometer used to measure the pressure of gas in a container. Atmospheric pressure is 76 cm of mercury.



What is the pressure of the gas?

- A 56cm of mercury
- B 68cm of mercury
- C 84cm of mercury
- D 96cm of mercury

[1]

13 Brownian motion is observed when looking at smoke particles in air using a microscope.

What causes the smoke particles to move at random?

- A Smoke particles are hit by air molecules.
- B Smoke particles are moved by convection currents in the air.
- C Smoke particles have different weights and fall at different speeds.
- D Smoke particles hit the walls of the container.

[1]

During a period of hot weather, the atmospheric pressure on the pond in Fig. 3.1 remains constant. Water evaporates from the pond, so that the depth h decreases.

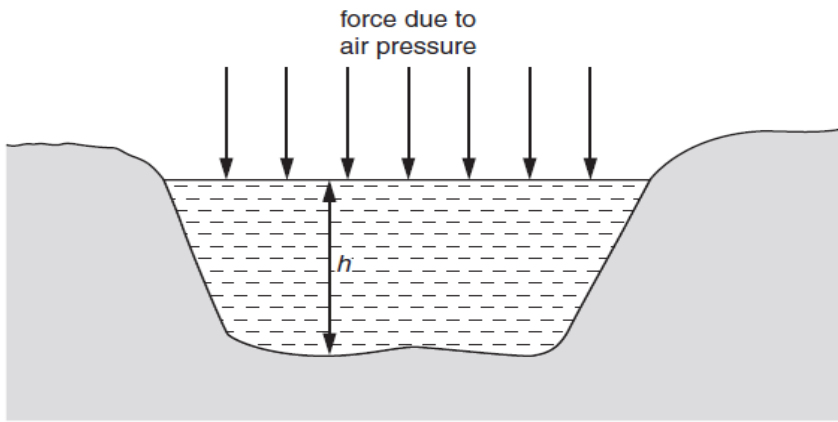


Fig. 3.1

(a) Study the diagram and state, giving your reason, what happens during this hot period to

(i) the force of the air on the surface of the pond,

.....
[1]

(ii) the pressure at the bottom of the pond.

.....
[1]

(b) On a certain day, the pond is 12 m deep.

(i) Water has a density of 1000 kg/m^3 .

Calculate the pressure at the bottom of the pond due to the water.

pressure due to the water =[2]

(ii) Atmospheric pressure on that day is $1.0 \times 10^5 \text{ Pa}$.

Calculate the total pressure at the bottom of the pond.

total pressure =[1]

(iii) A bubble of gas is released from the mud at the bottom of the pond. Its initial volume is 0.5 cm^3 .

Ignoring any temperature differences in the water, calculate the volume of the bubble as it reaches the surface.

volume =[2]

(iv) In fact, the temperature of the water is greater at the top than at the bottom of the pond.

Comment on the bubble volume you have calculated in (b)(iii).

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

(a) The speed of light in air is known to be 3.0×10^8 m/s.

15 Outline how you would use a refraction experiment to deduce the speed of light in glass. You may draw a diagram if it helps to clarify your answer.

.....
.....
.....
.....
.....[4]

(b) A tsunami is a giant water wave. It may be caused by an earthquake below the ocean.

Waves from a certain tsunami have a wavelength of 1.9×10^5 m and a speed of 240 m/s.

(i) Calculate the frequency of the tsunami waves.

frequency =[2]

16

A simple motor is made in a school laboratory. A coil of wire is mounted on an axle between the poles of a horseshoe magnet, as illustrated in Fig. 9.1.

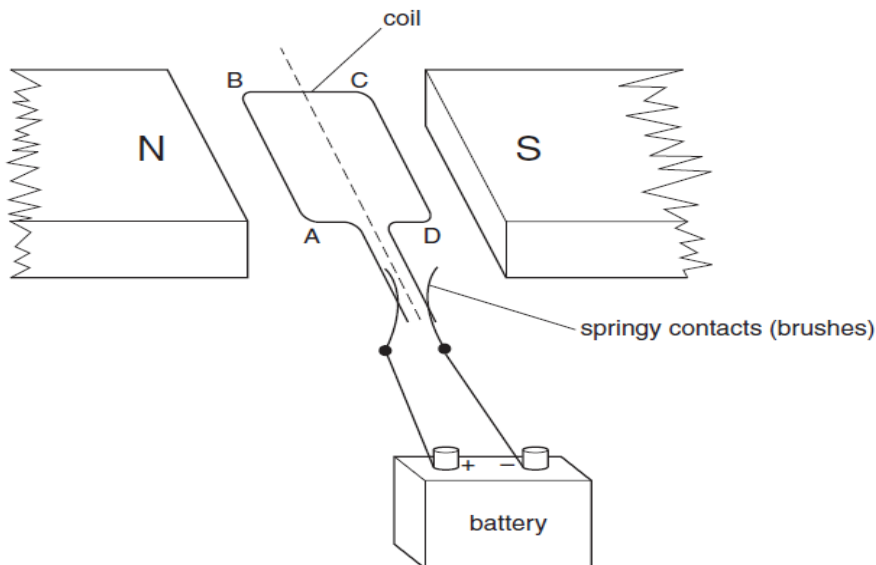


Fig. 9.1

(a) At the instant illustrated in Fig. 9.1, the coil ABCD is horizontal and the battery is connected as shown.

(i) For this position, state the direction of the force on AB and the direction of the motion of AB.

force on AB
direction of motion of AB [1]

(ii) Explain why BC does not contribute to the turning force on the coil.

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

(b) At the instant when the coil is vertical, the springy contacts do not, in fact, make contact with the ends of the coil.

Describe and explain what happens to the coil.

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

(c) The motor in Fig. 9.1 does not rotate very quickly. The designer of a commercial motor is required to produce a faster-rotating motor.

Suggest **one** change that could be made to increase the speed of the motor.

.....

[3]

1 Fig. 1.1 shows a diagram of a cross-section of a dicotyledonous leaf, as seen using a light microscope.

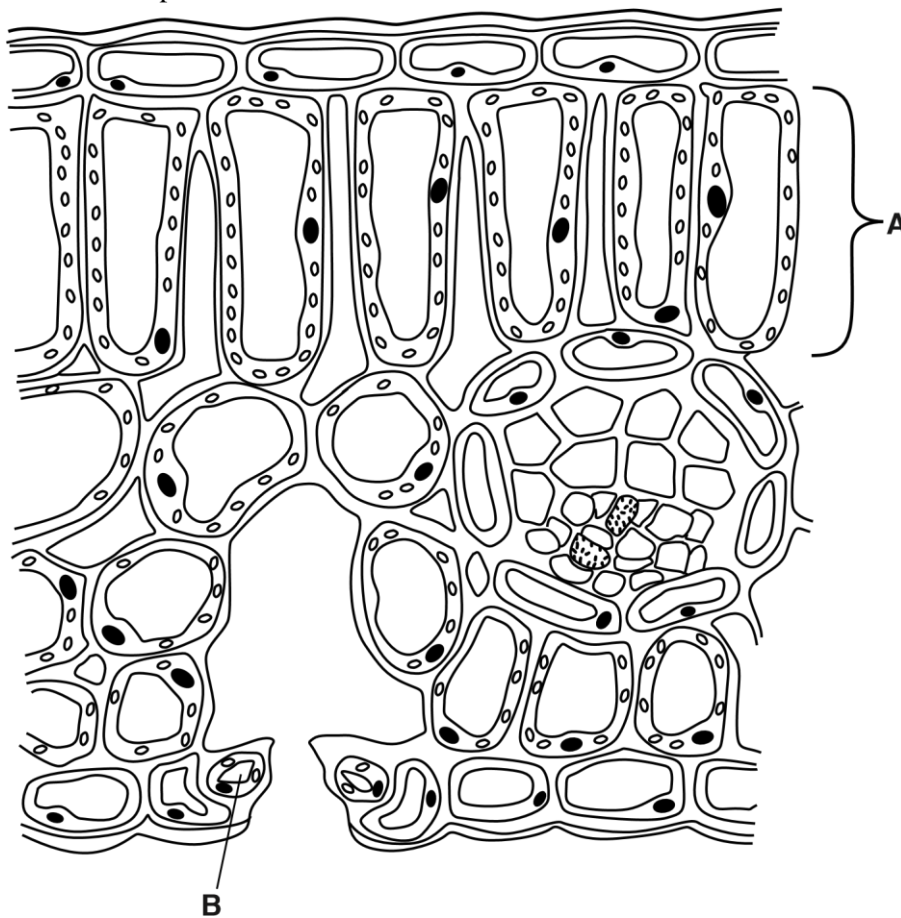


Fig. 1.1

(a) (i) Name tissue A and cell B.

A

B [2]

(ii) Describe **two** ways in which tissue A is adapted for maximum photosynthesis.

1

2 [2]

(b) Plants use carbon dioxide for photosynthesis.

(i) Describe where and how carbon dioxide enters a leaf.

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

(ii) State the **two** products of photosynthesis.

..... [1]

2 Coat colour in cattle is inherited in a very similar way to blood groups in humans. The gene for coat colour has two codominant alleles:

C^B which is the allele for brown coat

C^W which is the allele for white coat.

Table 2.1 shows the genotypes and phenotypes of different coat colours seen in a herd of cattle.

Table 2.1

genotype	phenotype
$C^B C^B$	brown
$C^W C^W$	white
$C^B C^W$	roan

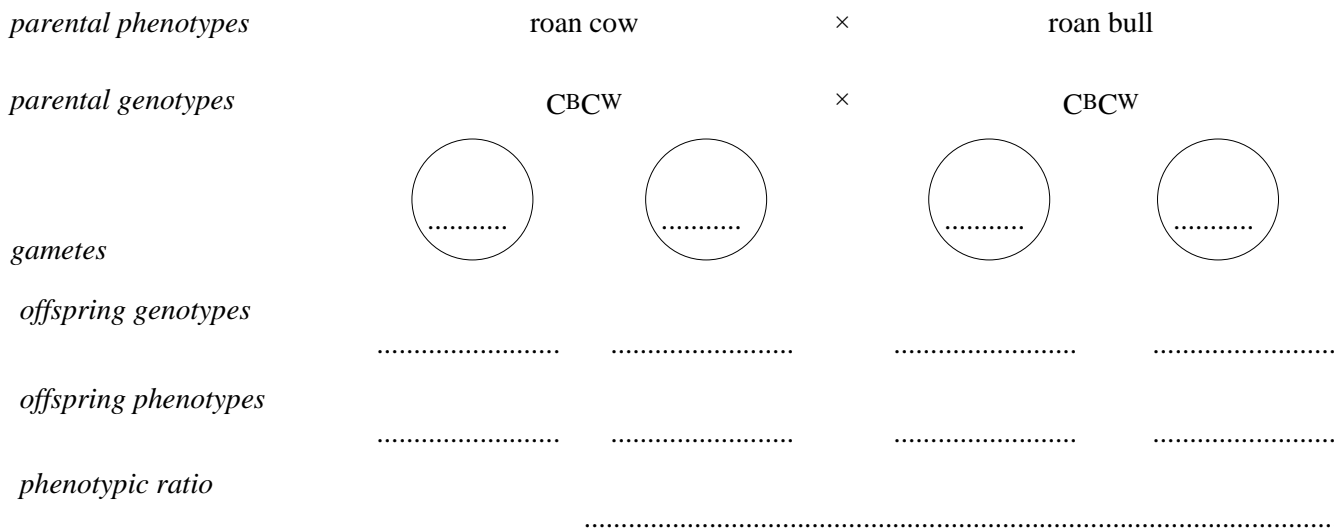
(a) (i) Explain the term *codominance*.

.....

 [2]

(ii) A farmer crossed several roan coloured cows with a roan coloured bull.

Complete the genetic diagram to show the ratio of expected phenotypes among the offspring.



3 (a) Fig. 1.1 shows the human gas exchange system. The functions of the parts of the gas exchange system are given in Table 1.1.

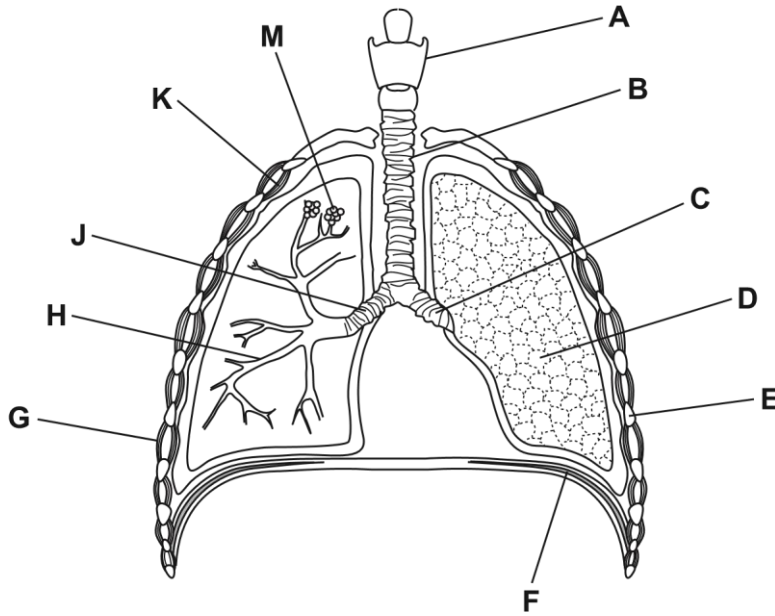


Fig. 1.1

Complete Table 1.1. One row has been done for you.

Table 1.1

function	letter on Fig.1.1	name
structure that makes sounds	A	larynx
bone that provides protection for the lungs		
airway that allows passage of air only into the right lung		
airway that allows passage of air into both lungs		
contracts to increase volume of thorax		
muscle that contracts to lower the ribcage		
site of gas exchange		

(b) The gas exchange system contains cartilage.

Describe the function of cartilage in the gas exchange system.

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

[2]

(c) Soon after starting physical activity the concentration of carbon dioxide in the blood increases.

(i) Name the process inside cells that produces carbon dioxide.

.....
.....

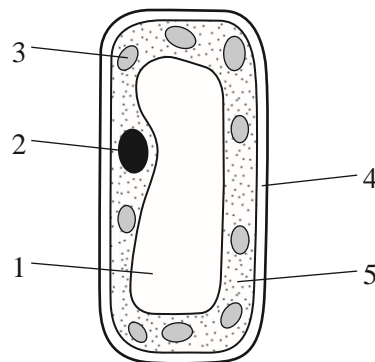
[1]

(ii) State the effect on breathing of an increase in carbon dioxide concentration in the blood.

.....
.....

[1]

4. The diagram shows the structure of a palisade cell.



[1]

Which features are also found in a liver cell?

- A** 1 and 2 **B** 2 and 5 **C** 3 and 4 **D** 4 and 5

5. Which nutrient produces a purple colour when mixed with biuret solution?

- a. fat
- b. protein
- c. reducing sugar
- d. starch

[1]

6. What is carried by the xylem?

- e. chlorophyll
- f. mineral ions
- g. starch
- h. sugars

[1]

7. Why is the circulatory system of mammals described as a double circulation?

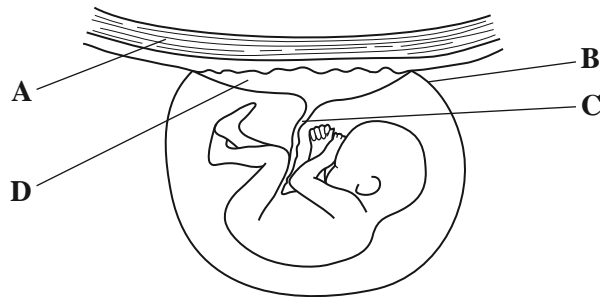
- i. Blood flows firstly through arteries and then through veins.
- j. Blood flows through the heart twice on one complete circuit of the body.
- k. In the heart, blood flows firstly through atria and then through ventricles.
- l. The atria and the ventricles contract alternately.

[1]

8. The diagram shows a developing fetus attached to the uterus of a pregnant woman.

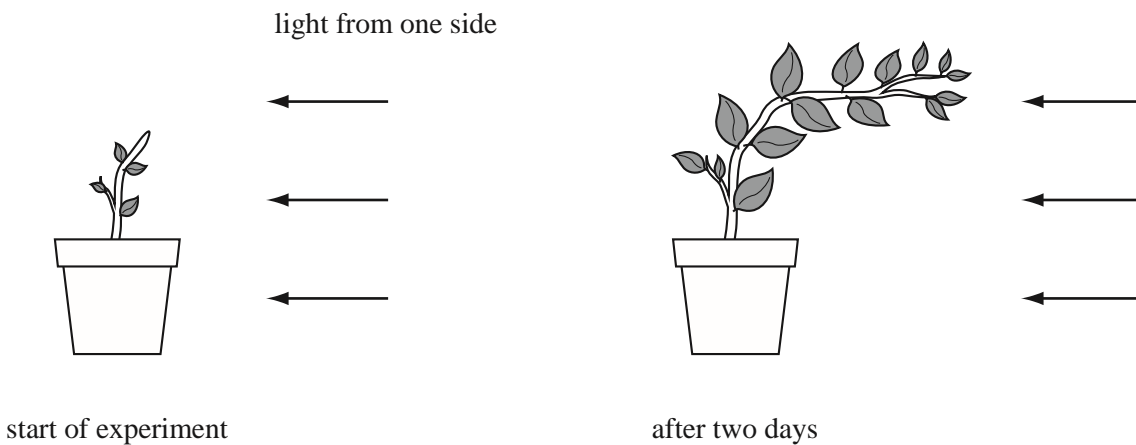
[1]

Which part is normally cut immediately after birth?



9. The diagrams show a plant at the start of an experiment, and the same plant two days later.

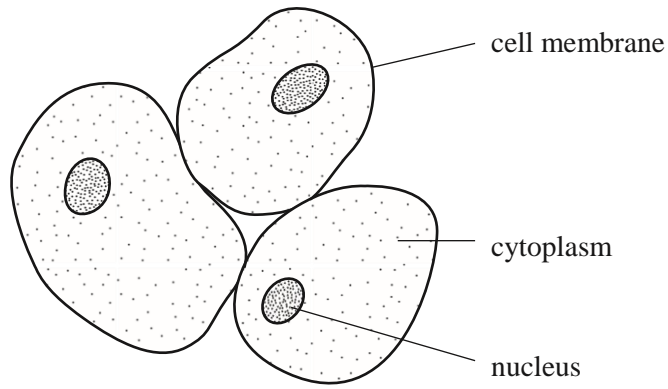
[1]



Which characteristic of living organisms is not demonstrated by this experiment?

- A excretion
- B growth
- C movement
- D sensitivity

10. The diagram shows some cells.

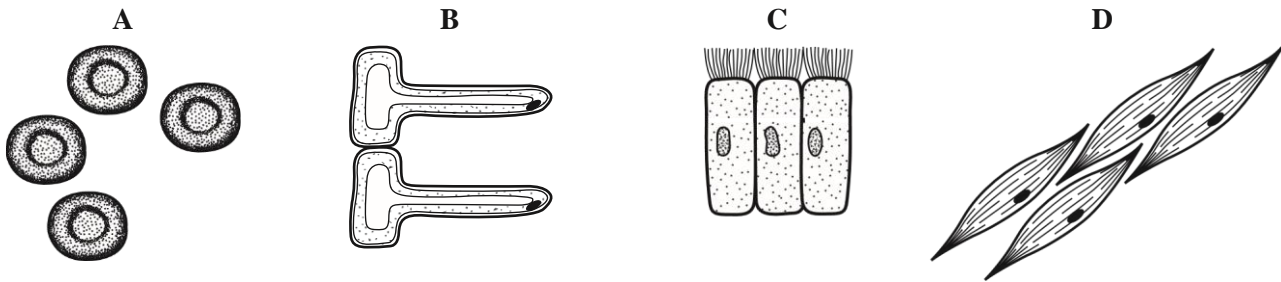


[1]

What are these cells?

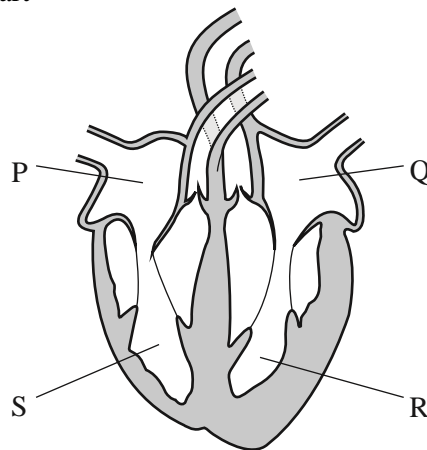
- a liver cells
- b palisade cells
- c red blood cells
- d white blood cells

11. Which cells line the trachea?



[1]

12. The diagram shows the human heart



In which order does blood pass through the chambers during a complete circuit of the body after it returns from the lungs?

- A Q → R → S → P
- B Q → R → P → S
- C P → S → Q → R
- D P → S → R → Q

[1]