

# International Junior Science Olympiad - Hong Kong Screening Sample Questions

**Time allowed: 1 hour 15 minutes**

## **Format of the Test Paper:**

### **Part (A) 30 Multiple Choice Questions (30 marks)**

*Instruction: Put your answers on the MC Answer Sheet. Each question carries 1 mark. Choose the BEST answers. No marks will be deducted for incorrect answers.*

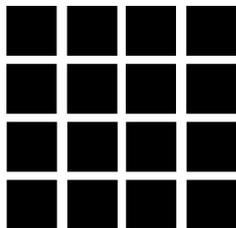
### **Part (B) 3 Structured-type Questions (30 marks)**

*Instruction: Put your answers on the Answer Sheet. Use a separate page for each question. You must answer all questions in English, or otherwise, all in Chinese.*

**Full Marks: 60**

## **(A) Sample Multiple Choice Questions**

1. When people look at the following squares, some small gray dots “are seen” at the intersections of the white lines.



The most probable reason is that

- A The eye receives wrong signals that the intersection points are gray.
  - B The nerves transfer the signals wrongly.
  - C The brain interprets that the intersection points are gray.
  - D The eye has a defect in colour detection.
2. What is the major source of tidal energy on Earth?
- A The radiation from the Sun.
  - B The gravitation due to the Moon.
  - C The rotation of the Earth.
  - D The internal energy of the water.

3. Which of the following substances is the LEAST reactive?

- A Nitrogen
- B Hydrogen
- C Oxygen
- D Chlorine

Study the following information and answer questions 4 to 6.

About 2000 years ago there was a famous judge in China. His name was Cheung Kui (張舉). He once took charge of a case in which a woman was suspected to kill her husband and then burn the body in their house. She pleaded not guilty and said her husband was burned to death by accident.

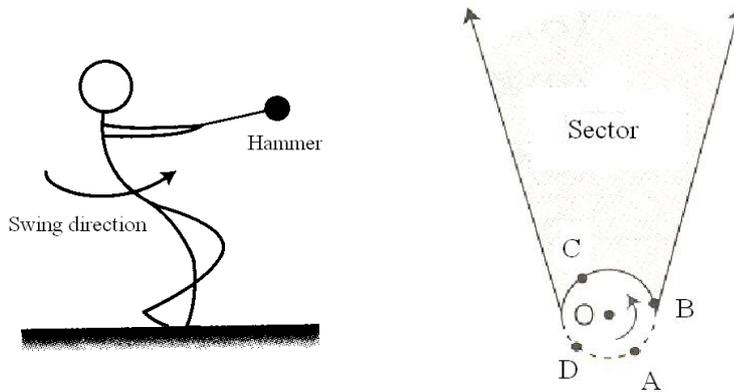
Judge Cheung performed an experiment to collect evidence for this case. Two pigs of similar size and weight were found. One pig (pig A) was first killed and then put in a hut with many wood logs. Another pig (Pig B), which was still alive, was put in another hut with many wood logs, too. Both huts were set on fire. The two dead pigs were then examined and Judge Cheung gathered evidence that it was indeed a murder case and the woman was convicted of the murder of her husband.

4. What observation if there is any would you expect to notice from the two pigs after the fire?

- A No observable difference between the bodies of Pig A and Pig B after the fire.
- B Ashes were found inside the mouth and nose of Pig B whilst there was no ash found inside the mouth and nose of Pig A.
- C Ashes were found inside the mouth and nose of Pig A whilst there was no ash found inside the mouth and nose of Pig B.
- D The skin colour of Pig A is darker than that of Pig B after the fire.

5. Judge Cheung did get strong forensic evidence from the experimental result that the woman was guilty. He used analogy to look for forensic evidence for the criminal case. From the viewpoint of modern science comment on the use of pigs to do experiment.
- A The choice of using pigs to do this analogy experiment is very good because both pigs and humans are mammals.
  - B The choice of using pigs to do this analogy experiment is very good because pigs and humans are genetically similar.
  - C The choice of using pigs to do this analogy experiment is very good because pigs and humans are very similar physiologically.
  - D None of the above.
6. Which of the following is the major ethical concern involved in the experiment?
- A Are animal right activities likely to disrupt pig reproduction?
  - B Are the pigs being supplied with sufficient food for stronger body?
  - C Will the pigs be eaten after the experiment?
  - D Will the pigs suffer great pain after the huts are set on fire?
7. During a javelin competition, the athlete throws the javelin in forward direction. When the javelin leaves the athlete's hand, it continues flying. Which of the following statements about the flight of the javelin is CORRECT?
- A The javelin is not affected by any external force.
  - B The javelin is pushed forward by air.
  - C The javelin maintains its inertia.
  - D Total force is zero

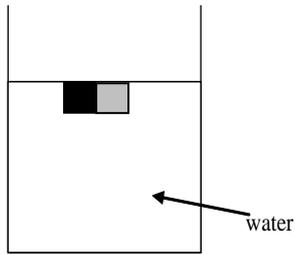
8. In a hammer throw competition, the athlete swings the hammer in anti-clockwise direction as in the left diagram below. If the athlete stands in position O as shown in the right diagram below, which point (A, B, C or D) should he/she release the hammer so that it will land within the sector?



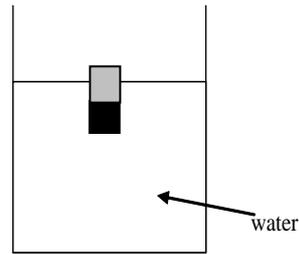
- A     A
- B     B
- C     C
- D     D

9. The densities of plastic and wood blocks are  $1.2 \text{ g/cm}^3$  and  $0.5 \text{ g/cm}^3$  respectively. If a plastic block and a wooden block of the same volume are stuck together and then put into water, which of the following figures best represents the observation?  
(The density of water is  $1.0 \text{ g/cm}^3$ )

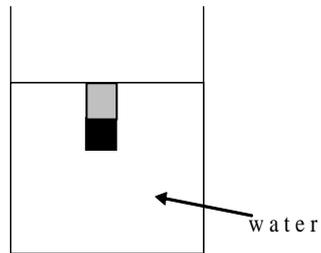
A.



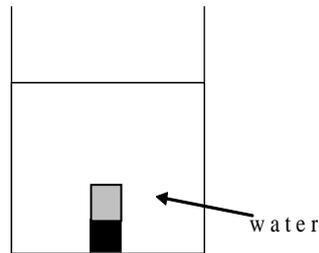
B.



C.



D.



10. Which of the following cell structures can be found in plant cells only?

- (1) cell wall
- (2) cell membrane
- (3) chloroplast
- (4) vacuole

- A (1) and (3) only
- B (2) and (4) only
- C (3) and (4) only
- D (1), (2) and (4) only

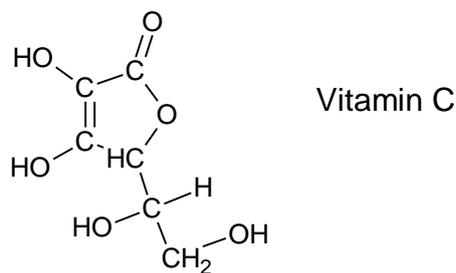
11. Which of the following statements about the features of Mars is INCORRECT?

- A The surface of Mars appears red because of the presence of Iron (III) oxide.
- B There are polar ice caps on Mars.
- C There is no atmosphere on Mars.
- D Mars takes longer to rotate around the Sun than the Earth does.

Read the information below and answer questions 12 and 13.

Vitamin C is important in human nutrition. It is involved in the formation of collagen(膠原蛋白), the principal protein in connective tissue(結締組織), and is required for the metabolism of several amino acids and for the absorption of iron. It functions as a reducing agent and can prevent vitamins A and E from oxidation. The suggested minimum daily intake of Vitamin C for an adult is 60 mg/per day. However, the dosage of most marketable Vitamin C tablet is 250 mg or 500 mg, which is many times the suggested daily dose. A large excess dose of Vitamin C can be toxic to 5% of the population. These people are deficient of an enzyme and thus susceptible to strong reducing agents.

The formula for Vitamin C is



12. The chemical formula of Vitamin C is

- A  $C_6H_6O_3$
- B  $C_6H_8O_6$
- C  $C_3H_3O$
- D  $C_3H_4O_3$

13. Which of the following statement is INCORRECT?

- A Vitamin C is required for the absorption of iron.
- B Taking too much Vitamin C may pose a health hazard.
- C We need at least 60 mg/per day of Vitamin C.
- D Vitamin C slows down the formation of the collagen.

14. Which of the following combinations correctly describes the adaptation of an organism to its mode of nutrition?

Organism

Adaptation to its mode of nutrition

A. tapeworm

has suckers to absorb nutrients from the host.

B. cow

has pointed teeth to cut grass.

C. maize

has green leaves to carry out photosynthesis.

D. honey bee

has a needle to kill its prey.

15. Melamine(三聚氰胺)( $C_3N_6H_6$ ) is a chemical widely used in industry for the manufacture of resins and plastics. In recent years, it was found that melamine had been illegally added to milk products in order to significantly boost the apparent level of protein because the protein level of milk was determined by analysing the amount of

A Carbon

B Hydrogen

C Oxygen

D Nitrogen

16. Scientists are concerned with atomic and subatomic levels and correspondingly small units. Nano-technology, using nano units, is being researched and developed by chemists and engineers and is being believed by medicinal researchers as a possible useful tool in surgery. 1 nanometer = 1nm =  $10^{-9}$  m

How much is 0.000025 m in terms of nanometers?

A  $2.50 \times 10^9$  nm

B  $1.25 \times 10^{-8}$  nm

C  $2.50 \times 10^4$  nm

D  $1.35 \times 10^{-11}$  nm

17. Exercise is good for our health because it can increase

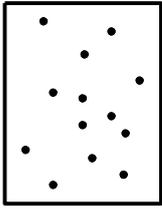
A the blood pressure of our body.

B the strength of our heart.

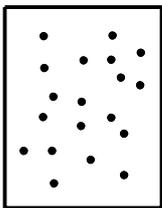
C the removal of minerals through sweating.

D the rate of formation of urine.

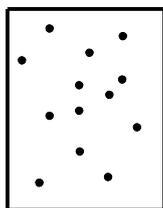
18. The diagram shows the distribution of particles of nitrogen gas in a sealed container at 10°C and 30 atmospheric pressure.



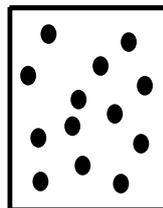
Suppose the gas in the sealed container was heated to 40°C. Which of the following diagrams below best illustrates the new distribution of the particles of nitrogen gas?



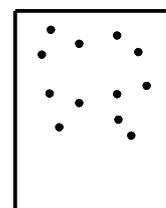
A



B

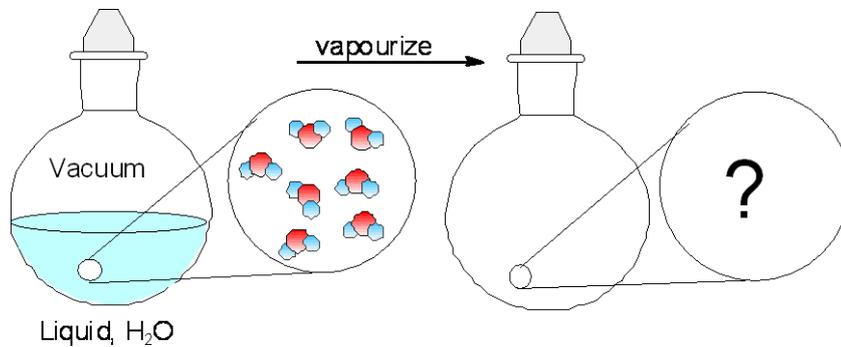


C

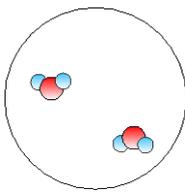


D

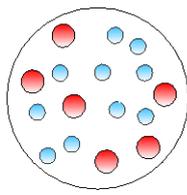
19. A sample of water ( $H_2O$ ) is completely vaporized to the gas state inside a closed container as shown below:



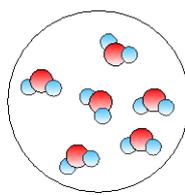
Which of the following diagrams best represents the same area of the magnified view of the vapour?



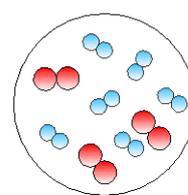
A.



B.



C.

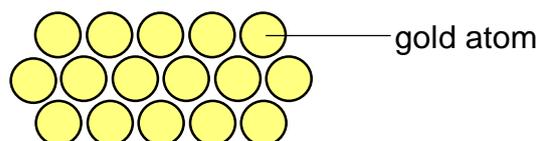


D.

20. When a gun is fired, a shower of fine and vaporized particles is released. The particles condense in the air and slowly settle as dust. If an analysis of the dust at a crime scene reveals the presence of lead(鉛), antimony(銻) and barium(鋇), it is a strong evidence that a gun has been fired. The following can be used as a defense against such an evidence, EXCEPT:

- A A recent celebration at the crime scene used fireworks, which can leave the same residue.
- B Shoes can transfer dust easily. Before attending the crime scene, detectives had carried out shooting practice.
- C Vehicle brake pads (汽車剎車印) may contain these chemicals. It was found that the property owner of the crime scene was a car mechanic.
- D Residues containing lead, antimony and barium were found at other locations where a gun has been fired.

21. The following diagram represents the solid state arrangement of atoms in a piece of gold.



Which of the following statements is CORRECT?

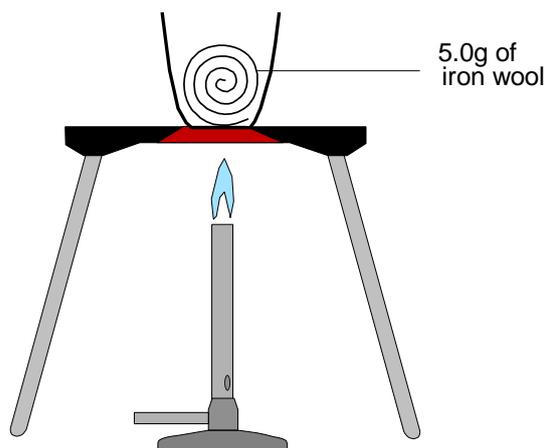
- A The spaces among gold atoms contain air.
- B The gold atoms vibrate continuously about their positions.
- C A piece of gold can conduct electricity by the movement of gold atoms.
- D Gold atoms would become lighter when gold solid melts.

22. Which of the following organisms may cause diseases in man?

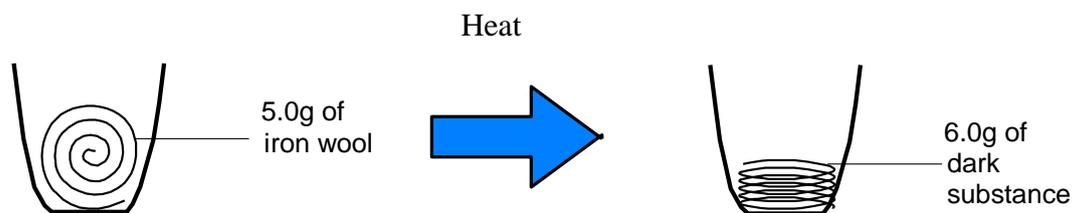
(1) virus (2) fungus (3) bacterium

- A (1) only
- B (3) only
- C (1) and (3) only
- D All of the above

23. Consider the following apparatus:



5.0 gram of iron wool was weighed and placed in a crucible. After strong heating for a few minutes, it turned into a “dark substance” and its mass was increased to 6.0 gram.



Which of the following reasons best accounts for the increase in mass?

- A The increase in mass was due to formation of black carbon during heating.
- B During heating, oxygen reacts with iron to give iron oxides.
- C Dark substance traps some air and therefore weighs more.
- D The heat applied was turned into 1.0 gram of dark substance.

24. In human eyes, the light image is converted into nerve impulses by

- A iris.
- B lens.
- C optic nerve.
- D retina.

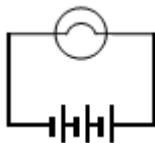
25. The table below shows the numbers of two species of barnacle found on a rocky sea-shore.

Height above water in low tide / m	0	1	2	3	4	5	6	7	8	9
Numbers of Barnacle A	3	13	23	72	77	64	23	12	2	0
Numbers of Barnacle B	0	0	12	7	23	44	56	53	29	7

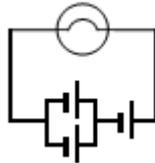
Which of the following factors affects the distribution of barnacles?

- A Barnacle A needs more light than Barnacle B.
- B Barnacle A is better camouflaged than Barnacle B.
- C Barnacle A has a greater reproductive capacity than Barnacle B.
- D Barnacle A is less tolerant of desiccation than Barnacle B.

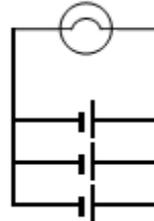
26. A light bulb is connected to the batteries with different combinations as shown. The internal resistance of the batteries can be neglected. Arrange the brightness of the light bulb in ascending order.



(1)



(2)



(3)

- A  $(2) < (3) < (1)$
- B  $(1) < (2) < (3)$
- C  $(3) < (2) < (1)$
- D  $(2) < (1) < (3)$

27. Which of the following things are likely to cause tooth decay?

- A Saliva, acid, sucrose
- B Amylase, glucose, virus
- C Sucrose, bacteria, alkali
- D Sugar, acid, bacteria

28. A boy grips a pen with two fingers as shown in the figure and the pen will not fall. Which of the following statements is CORRECT?

- A The force given out by the fingers is equal to the weight of the pen.
- B The force given out by the fingers is larger than the weight of the pen.
- C The friction exists between fingers and pen is equal to the weight of the pen.
- D The friction exists between fingers and pen is larger than the weight of the pen.



29. Which of the following statements about human swine flu is INCORRECT?

- A Human swine flu can be treated by antibiotics.
- B Human swine flu is caused by a kind of virus.
- C Human swine flu can be spread through personal contact.
- D A person could prevent human swine flu infection by not rubbing his eyes with his hands.

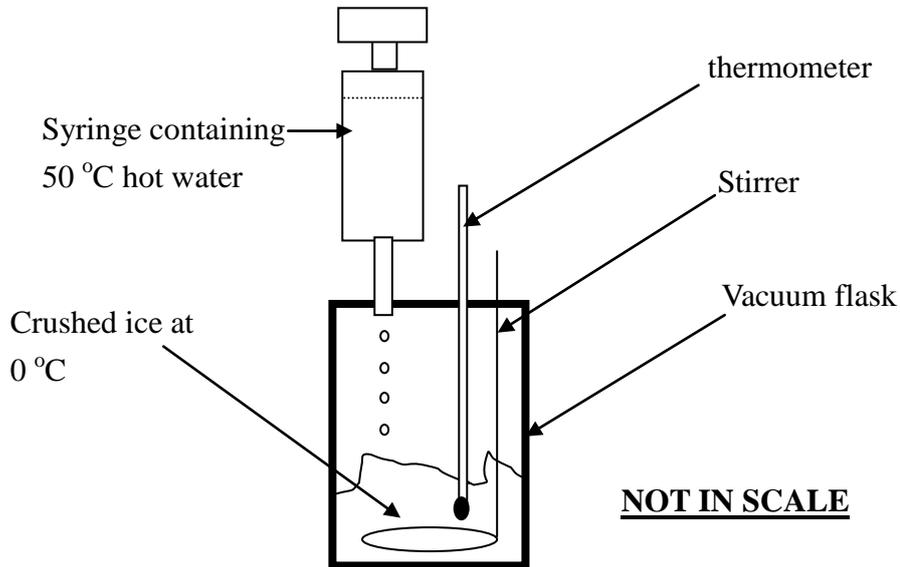
30. When the skin is infected by bacteria, the infected area will become swollen because

- A the blood capillaries dilate.
- B the bacteria are killed.
- C tissue fluid is accumulated in the infected area.
- D antibodies are produced in the infected area.

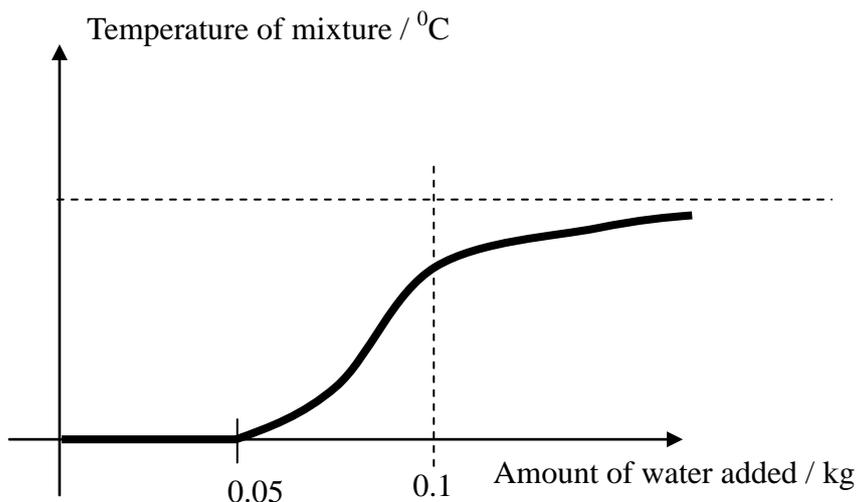
**(B) Sample Structured-type Questions**

**Question 1**

John carried out an experiment to investigate temperature change of the mixture when hot water at  $50^{\circ}\text{C}$  was added to the crushed ice at  $0^{\circ}\text{C}$ . The experimental set up was shown below:



At the beginning of the experiment, the crushed ice was at  $0^{\circ}\text{C}$ .  $0.01\text{ kg}$  of hot water was added to the vacuum flask each time and the mixture was stirred well. The temperature of the mixture was recorded 1 minute after each addition of hot water. The following graph shows the result of the experiment: (The room temperature is  $25^{\circ}\text{C}$ )



Graph 1

- (a) (i) Write down the state(s) of the mixture when 0.03 kg of hot water had been added .  
(1 mark)
- (ii) Give a reason why the temperature readings were taken 1 minute and not immediately after each addition of hot water. (1 mark)
- (b) What was the minimum amount of hot water needed for melting all the ice?  
(1 mark)

(c) Given that

- the heat energy,  $E$ , released when the temperature of  $m$  kg of liquid is dropped by  $\Delta T$  °C can be found by the formula,  $E = cm\Delta T$  ( $c$  is a fixed value called ‘specific heat capacity’ of the liquid)
- the heat energy,  $E$ , required to melt  $m$  kg of substance at its melting point can be found by the formula,  $E=ml$  ( $l$  is a fixed value called ‘specific latent heat of fusion’ of the substance)

(i) Calculate the heat energy released when 0.05 kg of hot water is cooled from 50°C to 0°C. (“Specific heat capacity” of water:  $4200 \text{ J kg}^{-1}\text{C}^{-1}$ ) (1 mark)

(ii) Let the mass of the ice used in the experiments be  $m$ , write down the expression for the heat energy required to melt the ice completely in terms of  $m$ . (“Specific latent heat of fusion” of ice :  $3.34 \times 10^5 \text{ J kg}^{-1}$ ) (1 mark)

(iii) If all the heat energy released by the hot water is used to melt the ice, estimate the mass of ice used in the experiment. (2

marks)

(d) If water hotter than 50°C is used to repeat the experiment, sketch a new curve on Graph 1 to show the change in temperature as the water is slowly added.

(2 marks)

(e) State one factor that should be kept unchanged in the experiment. (1 mark)

## Question 2

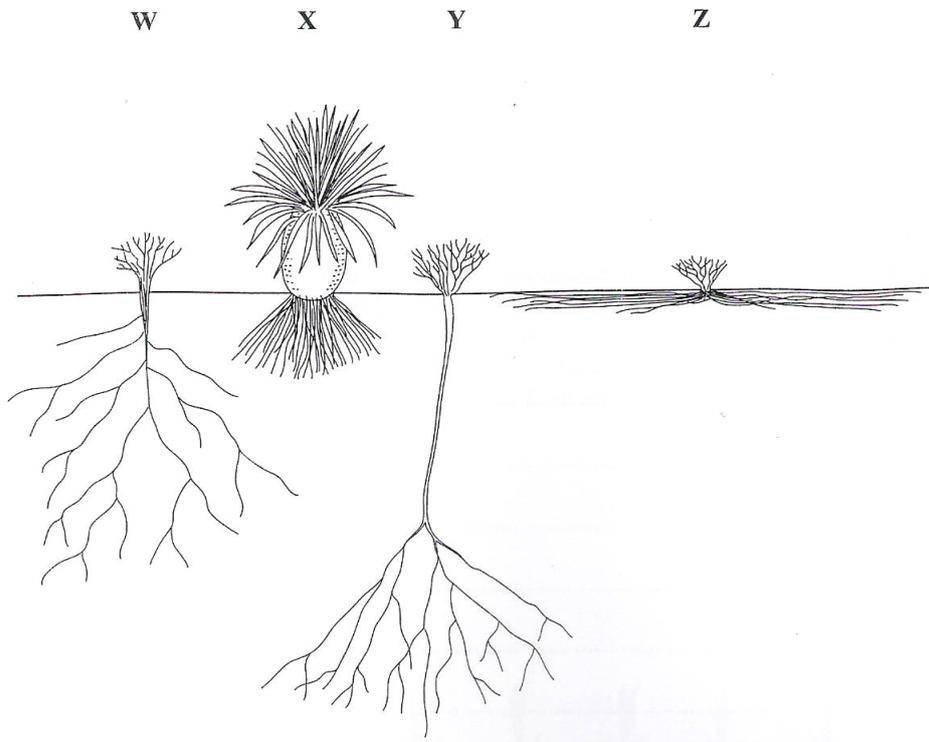
The table below gives some information about five metals.

Metal	Abundance in the earth's crust (%)	Price per kg (\$)	Relative resistance to corrosion (1 = least resistant 4 = most resistant)	Relative strength of metal (1 = lowest 4 = highest)	Relative density of metal (1 = lowest 4 = highest)
Aluminium	8.1	170	3	2	1
Copper	0.0055	140	3	3	3
Gold	0.0000004	1100000	4	1	4
Iron	5.0	20	1	4	3
Zinc	0.007	160	2	2	2

- (a) Although gold has a very low abundance in the earth's crust, gold was discovered by man a long time ago. Why? (1 mark)
- (b) Which of the metals in the above table is the most suitable for making hot water pipes? Explain your answer. (2 marks)
- (c) Give two advantages of aluminium over iron for making drink cans. (2 marks)
- (d) Describe an experiment to show that zinc is more reactive than iron. (2 marks)
- (e) Based on the information given in the table, suggest ONE factor that affects the price of a metal. (1 mark)
- (f) Suggest TWO other factors (not indicated in the table) that can also affect the price of a metal. (2 marks)

**Question 3**

The drawing shows four common plants found in the Mojave Desert.



- (a) Give two environmental conditions at desert that would lead to water deficit. (2 marks)
- (b) State and explain three structural features of the plants adapted to desert conditions. (6 marks)
- (c) Resurrection plants can lose up to 95% of their water content without dying. They can survive for many years in this desiccated state and will revive within hours of rainfall. Suggest which of the plants W, X, Y or Z is most likely to be a resurrection plant. Give a reason for your choice. (2 marks)