

**INTEGRATED SCIENCE 2**

**ESSAY [100 marks]**

**1 ¼ hours**

*This paper is in two sections: A and B. Answer Question 1 in section A and any other four questions in section B. Credit will be given for clarity of expression and orderly presentation of material.*

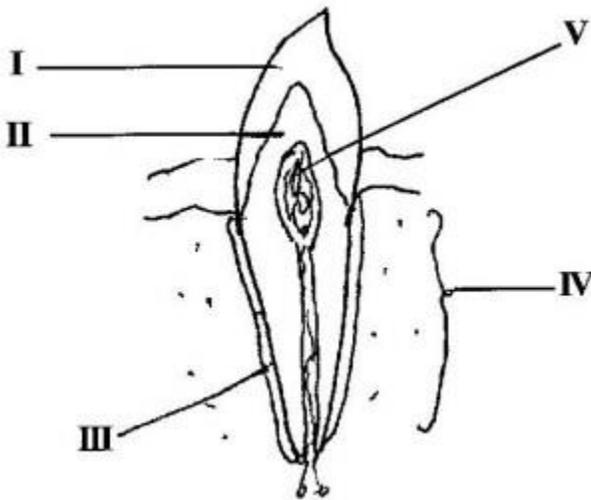
**SECTION A**

**[40 marks]**

Answer **all** of Question 1

1. (a) The diagram below is an illustration of a longitudinal section of a canine tooth in humans.

Study the diagram carefully and answer the questions that follow.



(i) Name each of the parts labelled I, II, III, IV and V. **[5 marks]**

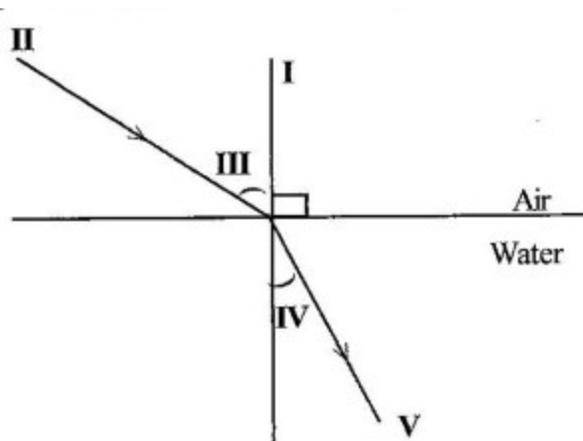
(ii) What is the function of each of the parts labelled I and III? **[2 marks]**

(iii) Which of the labelled parts could be affected by tooth decay? **[1 mark]**

(iv) State three ways by which tooth decay may be prevented. **[3 marks]**

(b) The diagram below is an illustration of a scientific phenomenon which occurs in nature.

Study the diagram carefully and answer the questions that follow.



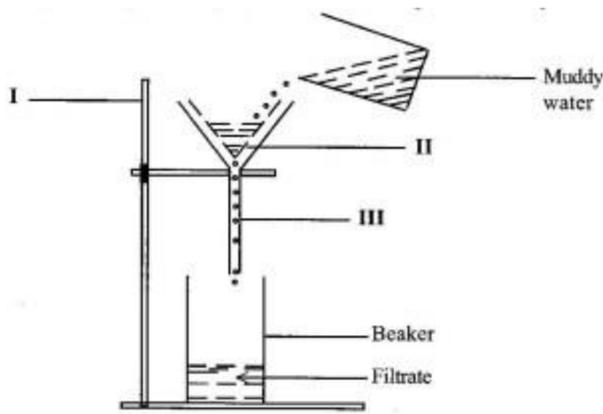
(i) What phenomenon does the diagram illustrate? **[1 mark]**

(ii) Identify each of the parts labelled I, II, III, IV and V. **[5 marks]**

(iii) Explain why an object at the bottom of a pond appears closer to the surface than it actually is. **[3 marks]**

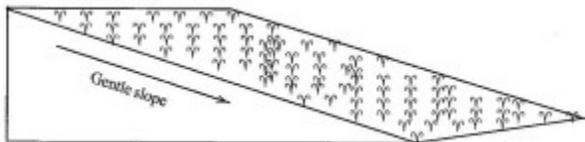
(c) The diagram below is an illustration of an experiment performed to separate the components of muddy water.

**Study the diagram carefully and answer the questions that follow.**



- (i) Name each of the parts labelled I, II and III. [3 marks]
  - (ii) State the function of the part labelled II. [1 mark]
  - (iii) Name the substance obtained as the filtrate. [1 mark]
  - (iv) State three physical properties of the filtrate. [3 marks]
  - (v) Name two other materials that could be used in place of the part labelled II. [2 marks]
- (d) The diagram below illustrates a farmland on a sloppy area.

Study the diagram carefully and answer the questions that follow.



- (i) What process is likely to occur on the farmland when it rains heavily? [1 mark]
- (ii) State two farming practices that can also lead to the process mentioned in (i). [2 marks]
- (iii) List four farming practices that could be used to control the process mentioned in (i). [4 marks]
- (iv) Mention three soil resources that would be depleted from the farmland when it rains heavily. [3 marks]

## SECTION B [60 marks]

Answer **four** questions **only** from this section

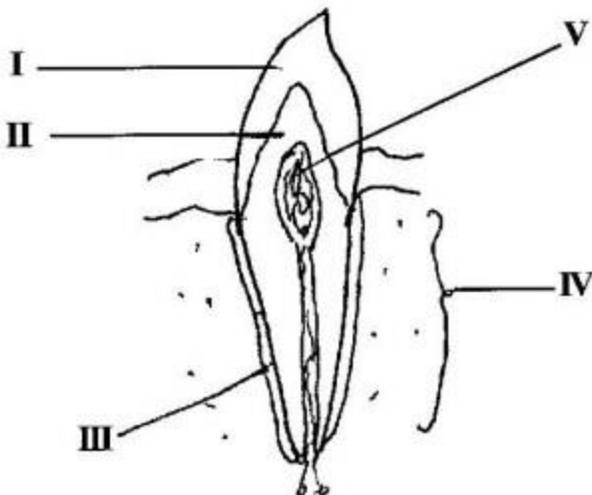
2. (a) An atom Y has atomic number 12. It loses two electrons in order to be stable.
    - (i) State the proton number of the atom before it loses electrons. [1 mark]
    - (ii) State the electron number of the atom:
      - (a) before it loses electrons.
      - (b) after losing electrons. [2 marks]
    - (iii) Name the type of ion formed by the atom when it loses two electrons. [1 mark]
  - (b) Name four farming systems used in crop production. [4 marks]
  - (c) (i) What is dispersal of seeds? [2 marks]
  - (ii) State two characteristics of seeds dispersed by wind. [2 marks]
  - (d) Explain the term forward bias of a p-n junction diode. [3 marks]
3. (a) (i) What is an acid? [2 marks]
  - (ii) Give two differences between an acid and a base, in terms of taste and feel. [2 marks]
  - (b) (i) Define pressure.
  - (ii) A force of 200 N is exerted on an area of 50 m<sup>2</sup>.  
Calculate the pressure exerted by the force. [3 marks]
  - (c) Explain the following terms as associated with living organisms:
    - (i) unicellular;
    - (ii) multicellular. [4 marks]
  - (d) Give two reasons why soil air is important. [2 marks]

4. (a) (i) Explain the following terms as applied to machines:  
 (α) work input;  
 (β) work output. [4 marks]  
 (ii) State one factor that limits work output for a given work input in a simple machine. [1 marks]
- (b) (i) What is chloroplast? [2 marks]  
 (ii) Differentiate between aerobic respiration and anaerobic respiration. [2 marks]
- (c) (i) State the colour change that would occur when blue litmus paper is dipped into a solution of:  
 (α) vinegar;  
 (β) wood ash. [2 marks]  
 (ii) Name the products formed when hydrochloric acid reacts with sodium hydroxide. [2 marks]  
 (d) List two benefits of vegetables to humans. [2 marks]
5. (a) (i) Differentiate between egestion and digestion in nutrition. [2 marks]  
 (ii) What is the end-product of digestion? [2 marks]  
 (b) Give one example of a chemical compound used in:  
 (i) medicine;  
 (ii) agriculture;  
 (iii) industry. [3 marks]  
 (c) (i) Define the term soil profile. [2 marks]  
 (ii) State two ways in which soil profile is important in crop production. [2 marks]  
 (d) (i) State two steps used by scientists in doing their work. [2 marks]  
 (ii) Give two subjects that may be considered as applied sciences. [2 marks]
6. (a) (i) What is an alloy? [2 marks]  
 (ii) State two causes of corrosion of metals. [2 marks]  
 (b) (i) What is a planet? [2 marks]  
 (ii) Name two planets between the Sun and the Earth. [2 marks]  
 (c) State four functions of the circulatory system in humans. [4 marks]  
 (d) (i) Define the term crop rotation. [2 marks]  
 (ii) Give one example of a chemical method of controlling pests on crop farms. [marks]

**END OF ESSAY TEST**

**SOLUTIONS**

1. (a) The diagram below is an illustration of a longitudinal section of a canine tooth in humans.



Study the diagram carefully and answer the questions that follow.

(i) Name each of the parts labelled I, II, III, IV and V. [5 marks]

I – Crown / Enamel

II – Dentine

III – Cement / Periodontal membrane

IV – Jaw bone / Root

V – Pulp Cavity

(ii) What is the function of each of the parts labelled I and III? [2 marks]

I – Protects teeth from harmful bacteria

– Enable teeth withstand pressure of chewing

– Cutting / chewing / protects dentine / protect pulp cavity

III – hold tooth firmly (in socket / Jaw bone)

(iii) Which of the labelled parts could be affected by tooth decay? [1 mark]

V – Pulp cavity

(iv) State three ways by which tooth decay may be prevented. [3 marks]

♣ avoid using sharp-pointed objects

♣ avoid having dry mouth

♣ use water containing fluorides to wash teeth / mouth

♣ avoid smoking

♣ the teeth should be cleaned regularly after each meal / remove food particle from the teeth / flossing

♣ wash the mouth vigorously after each meal

♣ regular visit to the dentist

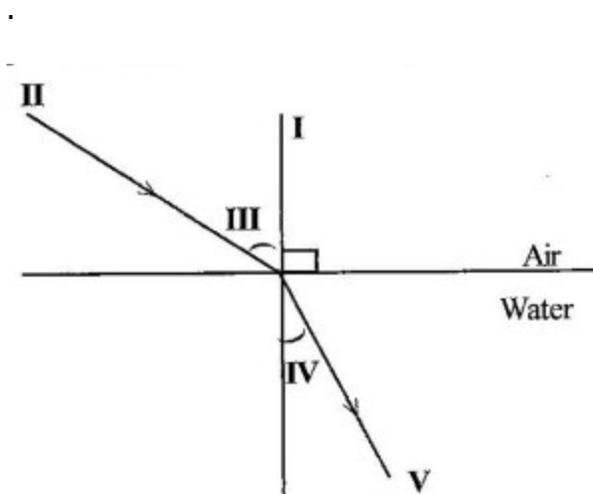
♣ avoid eating too hot foods

♣ avoid eating too much sugary food

♣ avoid eating too cold food / taking too cold drinks

(b) The diagram below is an illustration of a scientific phenomenon which occurs in nature.

Study the diagram carefully and answer the questions that follow.



(i) What phenomenon does the diagram illustrate? [1 mark]

Refraction of light

(ii) Identify each of the parts labelled I, II, III, IV and V. [5 marks]

I – Normal

II – Incident ray

III – angle of incidence / incident angle

IV – angle of refraction

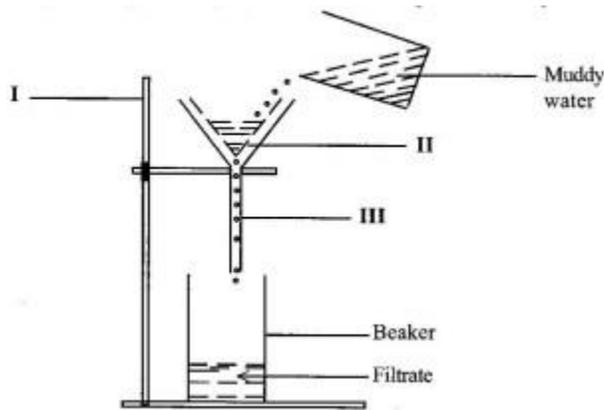
V – refracted ray

(iii) Explain why an object at the bottom of a pond appears closer to the surface than it actually is. [3 marks]

Rays from the object at the bottom are bent away from the normal as they come out of the water. In a straight line, these rays appear to come from a point above the bottom

(c) The diagram below is an illustration of an experiment performed to separate the components of muddy water.

Study the diagram carefully and answer the questions that follow.



(i) Name each of the parts labelled I, II and III. [3 marks]

I – Retort / clamp stand

II – filter paper

III – funnel

(ii) State the function of the part labelled II. [1 mark]

♣ to prevent the residue / solid / insoluble particles / mud from entering the filtrate

♣ to filter (solid / insoluble particles / residue)

♣ to separate the mud, solid / insoluble particles from the water

(iii) Name the substance obtained as the filtrate. [1 mark]

Water

(iv) State three physical properties of the filtrate. [3 marks]

♣ it has a density of  $1 \text{ g cm}^{-3} / 1000 \text{ kg m}^{-3}$

♣ it boils at  $100^\circ\text{C}$

♣ it freezes at  $0^\circ\text{C}$  (at 1 atm)

♣ it is colourless

♣ it is tasteless / insipid

♣ it is odourless

♣ it has a high surface tension, etc

(v) Name two other materials that could be used in place of the part labelled II. [2 marks]

♣ foam

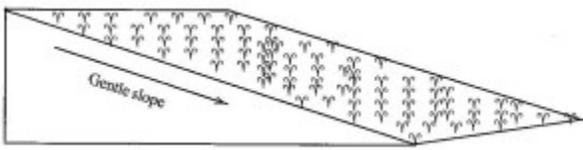
♣ cotton wool

♣ glass wool

♣ Clean / white cloth

(d) The diagram below illustrates a farmland on a sloppy area.

Study the diagram carefully and answer the questions that follow.



(i) What process is likely to occur on the farmland when it rains heavily? [1 mark]

Erosion

(ii) State two farming practices that can also lead to the process mentioned in (i). [2 marks]

- ♣ Deforestation
- ♣ bush burning
- ♣ continuous cropping
- ♣ cultivation / ploughing along slope
- ♣ crop removal
- ♣ excessive use of chemical / inorganic fertilizers
- ♣ overgrazing

(iii) List four farming practices that could be used to control the process mentioned in (i). [4 marks]

- ♣ planting cover crops
- ♣ terracing
- ♣ cultivating / ploughing across slope / contour
- ♣ heavy mulching
- ♣ constructing drainage channels
- ♣ planting trees beside farm
- ♣ strip cropping
- ♣ contour bunding

(iv) Mention three soil resources that would be depleted from the farmland when it rains heavily. [3 marks]

- ♣ soil organisms
- ♣ nutrients (macro / micro) / mineral matter
- ♣ soil particles / mineral matter
- ♣ growing crops
- ♣ air
- ♣ organic matter / humus

## SECTION B

[60 marks]

*Answer **four** questions **only** from this section*

2. (a) An atom Y has atomic number 12. It loses two electrons in order to be stable.

(i) State the proton number of the atom before it loses electrons. [1 mark]

12

(ii) State the electron number of the atom: [2 marks]

(a) before it loses electrons.

12

(β) after losing electrons.

10

(iii) Name the type of ion formed by the atom when it loses two electrons.

[1 mark]

Cation / positively charged ion

(b) Name four farming systems used in crop production. [4 marks]

- ♣ Land rotation
  - ♣ Crop rotation
  - ♣ Mixed cropping
  - ♣ Mixed farming
  - ♣ Organic farming
  - ♣ Monoculture
  - ♣ Mono cropping
  - ♣ Shifting cultivation
  - ♣ Ecological farming / Eco-farming
- (c) (i) What is dispersal of seeds? [2 marks]

It is a process by which seeds are carried away from the parent plant  
(ii) State two characteristics of seeds dispersed by wind. [2 marks]

- ♣ seeds are very small
  - ♣ they are very light
  - ♣ they have hair
  - ♣ they have wing-like structures / parachutes
- (d) Explain the term forward bias of a p-n junction diode. [3 marks]

It is when the positive terminal of an electric source is connected to the p-type of the diode and the negative terminal of the source is connected to the n-type of the diode, resulting in the flow of charges / current.

3. (a) (i) What is an acid? [2 marks]

It is a proton donor

OR

A substance or compound that produces excess hydrogen ion (H+) in water

OR

A substance that contains replaceable hydrogen

(ii) Give two differences between an acid and a base, in terms of taste and feel. [2 marks]

	Acid	Base
Taste	Sour	Bitter
Feel	Non slippery / stinging	Slippery / soapy

(b) (i) Define pressure.

It is the force acting (normally) per unit area

OR

Pressure = Force/Area

(ii) A force of 200 N is exerted on an area of 50 m<sup>2</sup>.

Calculate the pressure exerted by the force. [3 marks]

Pressure = Force/Area

= 200/50

= 4 Pa OR 4 Nm<sup>-2</sup>

(c) Explain the following terms as associated with living organisms: [4 marks]

(i) Unicellular –

(Very small) living organisms that consist of only one cell.

(ii) Multicellular –

(Large) living organisms that consist of (many) cells

(d) Give two reasons why soil air is important. [2 marks]

- ♣ It enhances the absorption of mineral salts / nutrients by plant roots
- ♣ It enhances the absorption of water by plant roots
- ♣ It makes oxygen available for seed germination
- ♣ Presence of aeration prevents the formation of toxic / acidic substances in the soil by micro organisms.
- ♣ Plant roots use soil air for respiration / metabolism / growth
- ♣ Soil micro organisms use soil air for respiration
- ♣ Air is required for the decomposition of organic matter.
- ♣ Aeration is required to prevent development of plant diseases

4. (a) (i) Explain the following terms as applied to machines: [4 marks]

(a) work input;

It is total energy / work applied to a machine for it to be able to work

(β) work output.

It is the total energy / work obtained by using machines to do work

(ii) State one factor that limits work output for a given work input in a simple machine. [1 marks]

- ♣ friction / wear and tear
- ♣ age of machine / period of usage
- ♣ weight of machine parts

(b) (i) What is chloroplast? [2 marks]

It is an organelle / structure found only in (plant) cell and it contains chlorophyll / green pigment

(ii) Differentiate between aerobic respiration and anaerobic respiration.

[2 marks]

<b>Aerobic Respiration</b>	<b>Anaerobic Respiration</b>
Requires oxygen	Does not require oxygen
Produces large amount of energy	Produces small amount of energy
Water is produced	Ethanol / lactic acid is produced

(c) (i) State the colour change that would occur when blue litmus paper is dipped into a solution of: [2 marks]

(a) vinegar; – changes to red

(β) wood ash. – there is no colour change / remains the same

(ii) Name the products formed when hydrochloric acid reacts with sodium hydroxide. [2 marks]

Sodium chloride and water

(d) List two benefits of vegetables to humans. [2 marks]

- ♣ Prevents constipation
- ♣ supply roughage for easy digestion of food.
- ♣ to garnish / decorate food
- ♣ provide humans with vitamins / proteins / mineral salts / carbohydrates / food nutrients / food
- ♣ source of medicine

5. (a) (i) Differentiate between egestion and digestion in nutrition. [2 marks]

Egestion is the removal of undigested food / semi-solid / waste / faeces from the anus while digestion is the breaking down of food into smaller building blocks / components that can be absorbed into the blood stream.

(ii) What is the end-product of digestion? [2 marks]

- ♣ glucose / simple sugar
- ♣ amino acids
- ♣ fatty acids and glycerol

(b) Give one example of a chemical compound used in: [3 marks]

(i) medicine;

Drugs / other pharmaceutical products, etc

(ii) agriculture;

Insecticides, pesticides, fertilizers, etc

(iii) industry.

Hydrochloric acid, sodium chloride, ethanol, ammonia, nitric acid, etc

(c) (i) Define the term soil profile. [2 marks]

It is the vertical section of the land showing the various horizons / layers and their composition

(ii) State two ways in which soil profile is important in crop production.

[2 marks]

- ♣ helps to know the type of tools to choose
- ♣ helps to select good soil for the crop
- ♣ to determine depth at which tillage implements must be set
- ♣ to know soil management practices to adopt
- ♣ helps to determine fertility of soil
- ♣ helps to determine type of crop to grow
- ♣ helps to know the water holding capacity of the soil.
- ♣ helps to determine the type of fertilizer to use / apply

(d) (i) State two steps used by scientists in doing their work. [2 marks]

♣ Identifying the problem

♣ Observation

♣ Experimenting

♣ Analyzing data

♣ Drawing conclusions

♣ Hypothesis

♣ Collection of data

(ii) Give two subjects that may be considered as applied sciences. [2 marks]

♣ Engineering

♣ Medicine

♣ Agriculture

♣ Pharmacy

♣ Electronics

♣ ICT

♣ etc

6. (a) (i) What is an alloy? [2 marks]

It is a uniform mixture of a metal and another metal or non-metal or two or more metals

(ii) State two causes of corrosion of metals. [2 marks]

♣ Presence of oxygen / air

♣ Presence of moisture / water

♣ Presence of alkali

♣ Presence of salt

♣ Presence of acid

(b) (i) What is a planet? [2 marks]

It is a heavenly body that moves round the sun / star

(ii) Name two planets between the Sun and the Earth. [2 marks]

♣ Mercury

♣ Venus

(c) State four functions of the circulatory system in humans. [4 marks]

- ♣ Transports blood
- ♣ Transports hormones / drugs / chemical
- ♣ Transports oxygen to cells / tissues / organs of the body
- ♣ Transports nutrients / glucose to organs
- ♣ Carries away excretory products / CO<sub>2</sub> / waste materials / urea.
- ♣ Regulates body temperatures / transport
- ♣ Consists of / transports white blood cells / antibodies / attack foreign bodies.
- ♣ Transports blood platelets to clot blood
- ♣ responsible for pumping blood / erection of penis / clitoris

(d) (i) Define the term crop rotation. [2 marks]

It is a system of farming where different types of crops are grown on the same piece of land but on different plots in a definite order / cycle / sequence from season to season.

OR

It is a system of farming where variety of crops are grown on the same piece of land in a repeated cycle

(ii) Give one example of a chemical method of controlling pests on crop farms.

[1 mark]

- ♣ spraying of recommended / appropriate pesticides
- ♣ placement of recommended / appropriate pesticides