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Name:	
School:	
Address:	
Class:	
Teacher:	

Pre-Leaving Certificate Examination, 2017
Triailscrúdú na hArdteistiméireachta, 2017

BIOLOGY – HIGHER LEVEL

TIME: 3 HOURS

Section A Answer any **five** questions from this section.
Each question carries 20 marks.
Write your answers in the spaces provided on **this examination paper.**

Section B Answer any **two** questions from this section.
Each question carries 30 marks.
Write your answers in the spaces provided on **this examination paper.**

Section C Answer any **four** questions from this section.
Each question carries 60 marks.
Write your answers in the **answer book.**

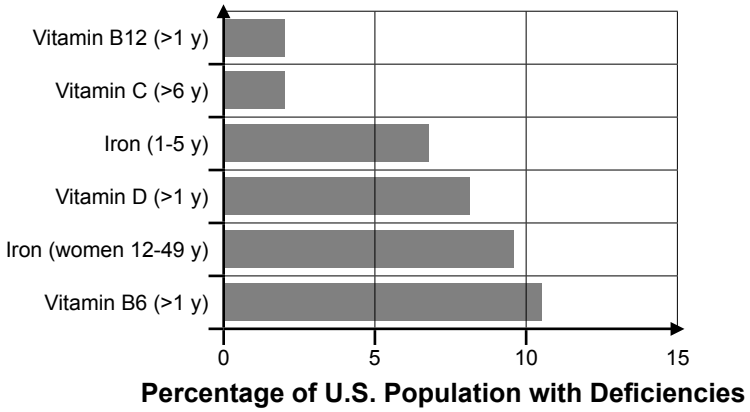
It is recommended that you spend not more than 30 minutes on Section A and 30 minutes on Section B, leaving 120 minutes for Section C.

You must return this examination paper with your answer book at the end of the examination.

Section A

Answer any <u>five</u> questions.
Write your answers in the spaces provided.

1. Study the graph below and answer the following questions.



(a) Why do you think iron deficiency is common in women in the 12-49 year age group?

_____

(b) Choose any one water soluble vitamin from the graph and indicate **one** good food source where it may be found.

Vitamin: _____ Source: _____

(c) Give any **one** structural role and any **one** metabolic role of fat.

Structural role: _____

Metabolic role: _____

(d) Name any **one** mineral present in dissolved salts and state its function in humans.

Mineral: _____ Function: _____

_____

(e) A particular food was tested using the biuret test (copper sulfate and sodium hydroxide) and a positive result was obtained.

1. Name any **one** food that would give a positive result with this test.

_____

2. Describe how you would know the result was positive.

_____

(f) State any **two** reasons water is needed by the body.

(i) _____

(ii) _____

2. (a) Name any **two** areas of study which are included in the overall study of biology.

(i) _____ (ii) _____

(b) Explain what is meant by the term *diversity* of living organisms.

_____

(c) Define the concept of *life*. _____

_____

(d) All living organisms share a number of characteristics, one of which is *organisation*. Describe this characteristic.

_____

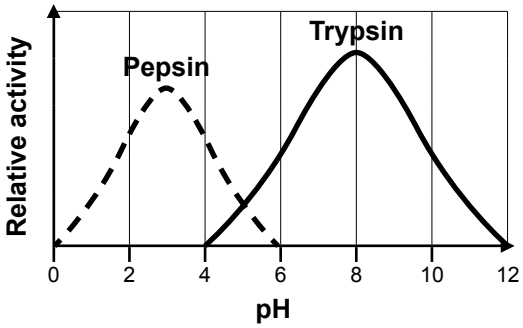
(e) Why is the process of *excretion* important to all living organisms?

_____

3. (a) With reference to the active site of an enzyme explain what is meant by *denaturation*.

_____

(b)



1. Comment on the effect of using a pH of 3 in investigations using pepsin and trypsin.

_____

2. How could you ensure the pH remains constant throughout the experiment?

_____

(c) As part of your practical activities you prepared an immobilised enzyme.

1. What are *immobilised* enzymes? _____

2. How did you immobilise the enzyme? _____

_____

(d) State any **one** industrial application of immobilised enzymes.

_____

4. (a) To which group of bases does *Guanine* belong? _____

(b) Name the type of bonding that exists between the strands of the DNA double helix.

_____

(c) What causes the double helix of DNA to unwind?

_____

(d) Explain the function of the enzyme RNA polymerase.

_____

(e) During protein synthesis in which part of the cell do the following processes occur?

1. Transcription _____

2. Translation _____

(f) After a protein is synthesised, it undergoes a process of folding. Why is this necessary?

_____

5. (a) Name any **two** external factors that regulate the growth of plants.

1. _____ 2. _____

(b) Internally the plant regulates growth by producing chemicals called growth regulators.

1. Name the **region** of the plant responsible for their production.

_____

2. Explain how these chemicals are transported within the plant.

_____

(c) Name any **one** growth regulator and state whether it promotes or inhibits growth.

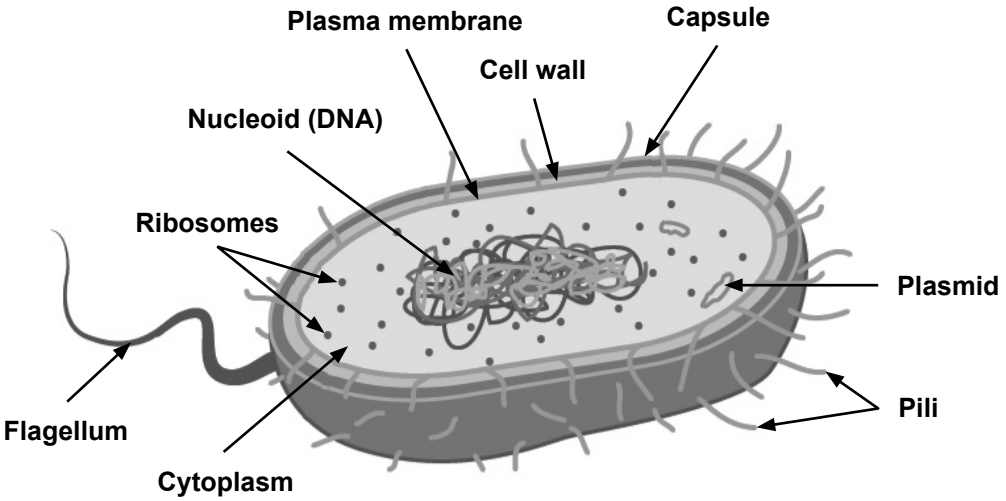
_____

(d) Plants protect themselves from adverse external environments in a number of ways. Name any **one** anatomical method and any **one** chemical method of protection found in plants.

Anatomical method: _____

Chemical method: _____

6. The diagram shows a typical bacterial cell.



(a) Is the bacterial cell shown in the diagram motile? _____

Explain your answer. _____

(b) Identify the parts of the bacterial cell responsible for:

1. Protection _____

2. Drug resistance _____

(c) Name any **one** organelle that is present in plant cells but absent in bacterial cells.

_____

(d) Explain the role of *endospores* in the life cycle of a bacterium.

_____

_____

(e) Some bacteria are classified as *chemosynthetic*. Explain this term and give **one** example of a group of chemosynthetic bacteria found in nature.

Chemosynthetic: _____

_____

Example: _____

Section B

Answer any <u>two</u> questions.
Write your answers in the spaces provided.
Part (a) carries 6 marks and part (b) carries 24 marks in each question in this section.

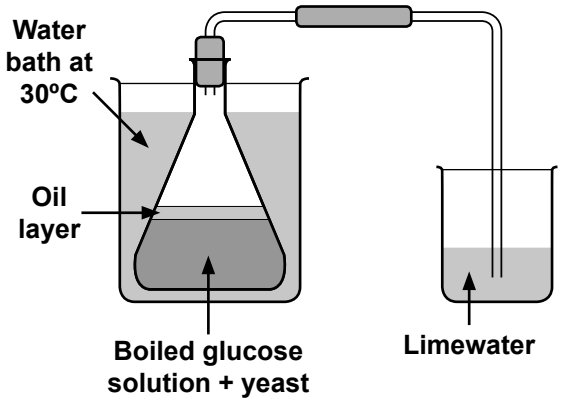
7. (a) (i) Name the molecule from which lactic acid is produced during glycolysis.

_____

(ii) In what part of the cell does Krebs Cycle occur?

_____

(b) (i) A group of students (Group A) set up the apparatus as shown opposite.



1. Indicate **two** features of their preparation that would indicate they are investigating anaerobic respiration.

   (i) _____

   (ii) _____

2. Using the apparatus shown in the diagram, suggest how the students would know that the glucose was used up?

   _____

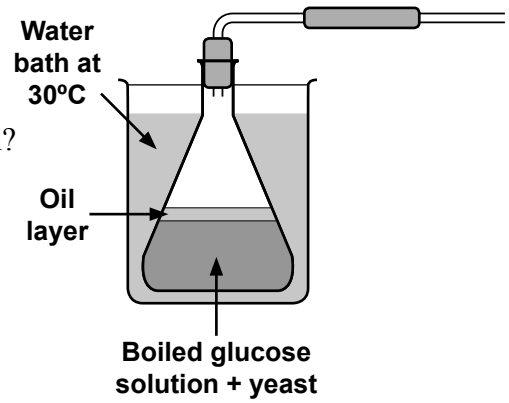
3. Explain why boiled yeast is a suitable control for use in this investigation.

   _____

4. Suggest another suitable control for this investigation.

   _____

(ii) A second group of students (Group B) set up the apparatus as shown opposite.



1. What effect would the absence of limewater have on their investigation?

   _____

   Explain your answer.

   _____

   _____

2. State **one** factor (apart from temperature) that each group must keep constant during this investigation.

   _____

8. (a) (i) Define the term *ecology*.

_____

(ii) Explain the purpose of *ecological pyramids*.

_____

(b) Answer the following questions in relation to a **named** ecosystem which you have investigated.

Ecosystem _____

(i) Name any **two** pieces of apparatus you used to collect animals from the ecosystem you studied.

Animal 1: _____ Apparatus used: _____

Animal 2: _____ Apparatus used: _____

(ii) In the case of **one** of the pieces of apparatus you have named in part (i) explain how you used it.

Apparatus: _____

How used: _____

_____

(iii) Describe the procedure you used to investigate any **one** named climatic factor.

Factor: _____

Procedure: _____

_____

(iv) How did you present the results of the quantitative surveys you carried out?

_____

(v) State any **one** way the investigation you carried out on your chosen ecosystem could have been improved.

_____

_____

_____

9. (a) (i) Define the term *metabolism*.

_____

(ii) Photosynthesis is an example of an *anabolic* reaction. Explain this statement.

_____

_____

(b) Answer the following in relation to investigations you carried out in the course of your practical studies.

(i) When investigating the factors that affect the rate of photosynthesis

1. How did you measure the rate of photosynthesis?

_____

2. State **one** possible source of error when carrying out these investigations.

_____

(ii) When investigating the growth of leaf yeasts

1. Was the investigation carried out in a sterile **or** aseptic environment?

_____

2. Explain your answer.

_____

_____

3. State any **two** precautions you took to ensure the investigation was carried out in this type of environment.

(i) _____

(ii) _____

(iii) When demonstrating the effect of osmosis

1. What characteristic of membranes were you demonstrating?

_____

2. What condition must exist on either side of the membrane for osmosis to occur?

_____

Section C

Answer any <u>four</u> questions.
Write your answers in the answer book.

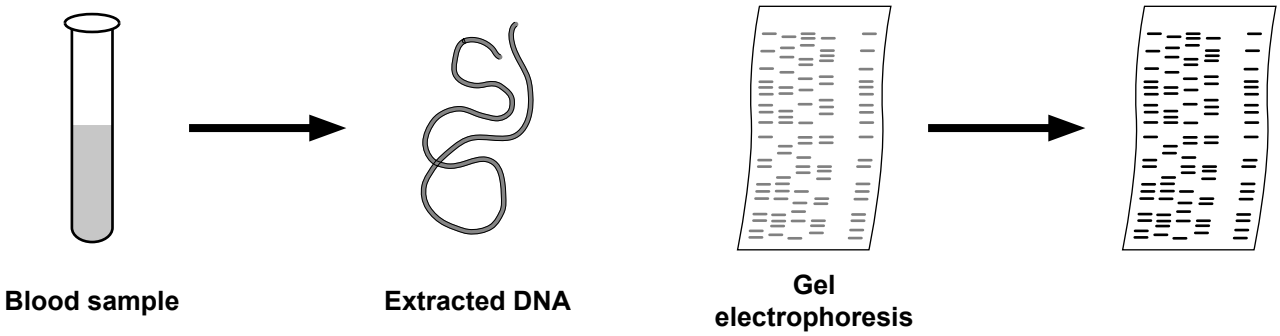
10. (a) Red hair occurs in about 1 – 2 percent of the population. It is caused by a recessive mutation in one gene, which is located on chromosome 16. Two parents, neither of whom have red hair, have a child with red hair.

(i) Write out the genotype of each parent (indicate clearly in your answer the letter you are using to represent red hair).

(ii) What is the chance of the next child also having red hair? (9)

(b) (i) Distinguish between *DNA profiling* and *genetic screening.*

(ii) The diagrams below show some of the stages involved in the process of DNA profiling. Stage 1 involves the extraction of DNA from a blood sample.



During your investigation to isolate DNA from plant tissue, describe the procedures you carried out to:

1. Break down the cell wall.
2. Break down the cell membrane.
3. Precipitate the DNA.

(iii) Which of these procedures is not required when extracting DNA from the blood sample? Give a reason for your answer.

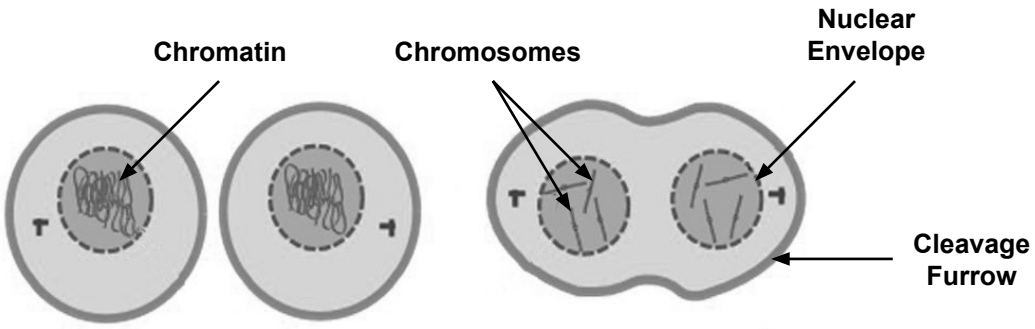
(iv) The resulting DNA fragments are separated by means of gel electrophoresis. On what basis are the fragments separated?

(v) The fragments are stained after they are separated. What is the purpose of this step? (27)

(c) (i) The cell cycle describes the cell's activities. Name the **two** stages of the cell cycle.

(ii) In multicellular organisms, state any **one** function of meiosis. State any **one** location in a plant where meiosis occurs.

(iii) Is the cell shown in the diagram below an animal or a plant cell? Give a reason for your answer.



Telophase and Cytokinesis

(iv) Name the phase that occurs **before** telophase and describe what happens to the chromosomes during that phase.

(v) What name is given to the group of disorders that result from the uncontrolled multiplication of cells?

(24)

11. (a) The dental formula of a dog is given below.

I 3/3; C 1/1; P 4/4; M 2/3

(i) How many teeth does an adult dog have?

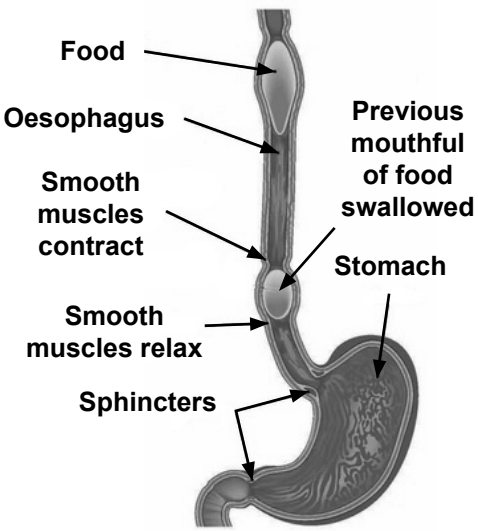
(ii) How many molars are present on the lower jaw?

(iii) In what type of digestion do teeth play a role? (9)

(b) (i) 1. The diagram opposite shows the movement of food along the oesophagus. What name is given to this process?

2. How does the body ensure that food enters the oesophagus and not the trachea?

3. What is the role of the sphincter muscles labelled in the diagram?



(ii) The stomach wall is protected by a mucosal barrier. However overuse of many common non-prescription medications (*e.g.* Aspirin, Ibuprofen) can lead to a gradual erosion of this barrier. Give **two** reasons this barrier is necessary.

(iii) When the partially digested food enters the duodenum *sodium bicarbonate* is added to it. State:

1. The site of production of the sodium bicarbonate,

2. Why it is necessary.

(iv) Name the organ in the body in which deamination occurs. (27)

(c) Most of the absorption of digested food takes place in the ileum.

(i) State the exact location of the ileum within the digestive system.

(ii) The ileum is approximately 8m long and has numerous infoldings called villi. Explain how both these features aid in the process of absorption.

(iii) Apart from the two features mentioned in part (ii), state **one** other way in which the ileum is well adapted to its function.

(iv) Describe how the end products of fat digestion reach the liver. (24)

12. (a) The cells in an embryo arrange themselves into three germ layers.

(i) Name **all** three germ layers.

(ii) In the case of **two** of the layers you have named, give **one** body system that develops from it. (9)

(b) (i) Sexual reproduction in humans is controlled by hormones. Suggest any **one** reason hormonal control is more appropriate than nervous control in this situation.

(ii) During the first few days of the menstrual cycle menstruation occurs.

1. What is menstruation?

2. Why does it occur?

(iii) Describe the structure of the *morula*. In what part of the female reproductive system is the morula located?

(iv) Name the part of the *blastocyst* which forms the placenta.

(v) Can the placenta be considered to be an endocrine gland? Explain your answer.

(vi) Name

1. The hormone responsible for causing the wall of the uterus to contract during labour

2. The gland responsible for its production. (27)

(c) (i) In the flowering plant, at what stage during the development of the male gametes does meiosis occur?

(ii) What is the function of the *generative nucleus*?

(iii) Describe the process of *double fertilisation*.

(iv) Comment briefly on the link between hay fever and pollen.

(v) What is the function of the growth regulators produced by seeds? (24)

13. (a) Nitrogen fixing bacteria often form symbiotic relationships with members of the legume family of plants (e.g. beans, peas, and clover). There are also nitrogen fixing bacteria in aquatic environments, e.g. blue-green algae (really a bacterium called cyanobacteria) is an important free-living nitrogen fixer.

(i) How do the bacteria benefit from this relationship with the legume?

(ii) Apart from the presence of blue-green algae in aquatic environments as mentioned above, where else would you expect to find free-living nitrogen fixers?

(iii) Apart from nitrogen fixing bacteria, state **one** other way atmospheric nitrogen is converted to nitrates. (9)

(b) Read the following extract and answer the questions that follow.

Japanese researchers have discovered a species of bacterium (*Ideonella sakaiensis*) capable of breaking down and consuming a common type of plastic called PET (polyethylene terephthalate). This is the type of plastic commonly found in disposable drinks containers. It is also found in polyester clothing, frozen dinner trays and blister packaging. It is the very properties that make PET attractive to companies — its durability and resistance to water — that also make it a danger to the environment. The team hope that their discovery will lead to new ways of breaking down PET, using either the bacteria themselves, or the two enzymes involved in the process. The importance of this breakthrough is apparent when one considers that plastics are not considered to be biodegradable at present, as it is thought to take up to 450 years for PET to biodegrade. As a result, vast quantities of plastic enter landfill sites every year and accumulate in the ocean.

The bacteria attach to the PET with tendril-like threads and then use two enzymes to sequentially break down PET into terephthalic acid and ethylene glycol, the two substances from which PET is made. The ability of the organism to reconstitute the starting materials is a useful recycling strategy; however the fact that the bacteria then digest both substances means that they could be used to get rid of polluting plastics in the environment. Having identified the enzymes involved in the process the team then identified the gene responsible for producing the enzymes, so they were then able to manufacture the enzymes in the laboratory. This allowed them to break down the PET using the enzymes alone.

(Adapted from "Bacteria Found to Eat PET Plastics Could Help do the Recycling" Science, Volume 351, Issue 6278, 2016)

(i) To which group of organisms do bacteria belong?

(ii) Apart from the properties mentioned in the article, give **one** other reason you think PET is widely used in packaging.

(iii) Name **both** end products of the breakdown of PET by *Ideonella sakaiensis*.

(iv) Give **one** advantage and **one** disadvantage of the use of landfill sites as part of a waste management strategy.

(v) How does the bacterium attach to the PET?

(vi) Why could the bacterium be used to get rid of polluting plastics in the environment?

(vii) Having identified the enzymes responsible for the breakdown of PET, what further steps did the researchers carry out? What was the significance of this work? (27)

(c) (i) An adaptation is a mutation that helps an organism, such as a plant or animal, survive in its environment. An adaptation can be structural or behavioural.

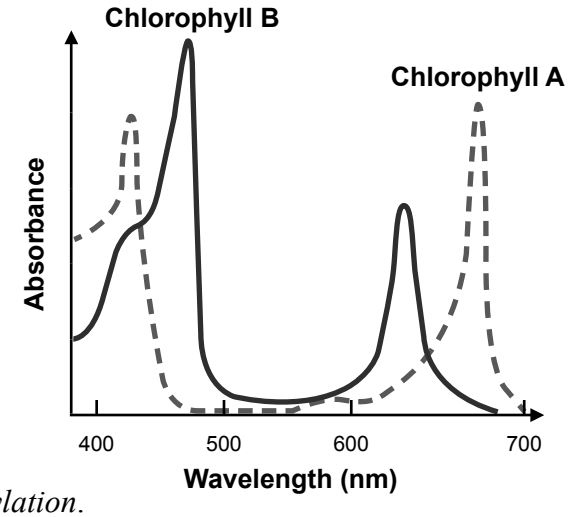
1. Explain clearly the difference between *structural* and *behavioural* adaptations.
2. Give **two** examples of structural adaptations from the animal kingdom. In your answer indicate how **each** adaptation is of benefit to the animal.
3. Give **one** reason an organism may need to undergo adaptations within its environment.

(ii) 1. Give **one** example of an *abiotic* factor from **both** a terrestrial and an aquatic environment.

2. State **one** example of an *environmental* factor of human origin that can affect a habitat. (24)

14. Answer any **two** of (a), (b), (c). **(30, 30)**

(a) (i) The graph shows the absorption spectrum of chlorophyll A and B.



1. Name the organelle within a cell in which chlorophyll is located.
2. At approximately what wavelength does most absorption by *chlorophyll B* occur?
3. If a plant had a pigment that absorbed light in the 500 – 600nm range, would this be an advantage or a disadvantage? Explain your answer.

(ii) During the light-dependent stage of photosynthesis, the excited electrons can enter one of two pathways. One of the pathways is called *non-cyclic photophosphorylation*.

1. Explain why this pathway is called a *non-cyclic* pathway.
2. What is the role of the electron transport chain in the process of photophosphorylation?

(iii) Describe the role played by $NADP^+$ in photosynthesis.

(iv) Suggest **one** way to increase crop growth in greenhouses, and explain why the method you have suggested would be effective.

(b) Read the passage below and answer the questions that follow.

Multiple Sclerosis (MS) is the most common autoimmune disorder affecting the central nervous system. The findings of two recent studies seem to suggest that maintaining adequate levels of vitamin D may have a protective effect and also lower the risk of developing MS. Other studies appear to indicate that for people who already have MS, vitamin D may lessen the frequency and severity of their symptoms. When a person has MS, the coating that protects the nerve cells is attacked by their own immune system. Research suggests that a connection between vitamin D and MS could be tied to the positive effects vitamin D has on the immune system. The link between vitamin D and MS is strengthened by the association between sunlight and the risk of MS. The farther away from the equator a person lives, the higher the risk of MS. In addition, in studies of a group of nurses, the risk of developing MS was substantially less for women taking 400 international units (IUs) or more of vitamin D a day. However large doses of vitamin D over an extended period can result in toxicity. Vitamin D toxicity can also lead to elevated levels of calcium in blood, which can result in kidney stones.

(i) Explain what is meant by the term *autoimmune disorder*.

(ii) Name the cell responsible for producing the coating that protects nerve cells.

(iii) In your opinion, what effect would damage to this coating have on the functioning of the nerve cell? In what part of the neurone is this coating located?

(iv) Why is it of benefit to people who already suffer from MS to take vitamin D?

(v) Why are kidney stones associated with the intake of large doses of vitamin D over a long time period?

(vi) Describe how a nerve impulse is transmitted across a synaptic cleft. Refer in your answer to the role played by ions and enzymes.

(c) Answer the following questions in relation to the human circulatory system.

(i) In terms of structure, state any **two** differences between the human blood and lymph systems.

(ii) Explain what is meant by a portal system.

(iii) What is a pulse?

(iv) State **two** ways in which the structure of a red blood cell differs from that of other human cells.

(v) From what part of the body is human blood pressure usually measured?

(vi) When a medical practitioner measures blood pressure, what exactly is being measured?

(vii) Human blood is classified into four different groups, A, B, AB, O. What other system is used to further classify blood?

15. Answer any **two** of (a), (b), (c). **(30, 30)**

(a) Fungi are a group of eukaryotic organisms that include both multicellular and unicellular members. All fungal cells have cell walls, composed of chitin. Fungi are the principal decomposers in nature.

(i) State any **one** feature of eukaryotic organisms.

(ii) Give **one** example of **both** a unicellular and a multicellular fungus.

(iii) In the case of **one** of the examples you have mentioned in part (ii), state whether the fungus is considered beneficial or harmful, and explain your answer.

(iv) To which group of biomolecules does *chitin* belong?

(v) Describe the type of nutrition found in Fungi.

(vi) Comment on the importance of their role as decomposers in nature.

(vii) Unicellular fungi undergo a process called *budding*. What is the purpose of this process?

(b) 1. (i) What is a tissue? In a plant, state **one** function of *dermal* tissue.

(ii) Xylem tissue is composed of both xylem tracheids and xylem vessels. Describe any **two** ways in which the structure of these cells differs from each other. Apart from transport of water and minerals, state **one** other function of xylem in plants.

(iii) State **one** feature xylem cells share with red blood corpuscles.

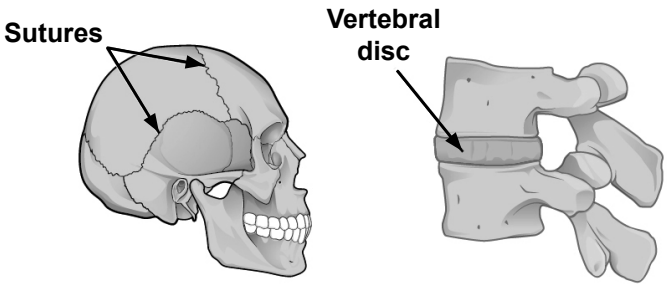
2. *Transpiration* is one of the mechanisms responsible for the movement of water from the roots to the leaves.

(i) Name the process by which water moves through the cortex of the root until it reaches the xylem.

(ii) Name the structures responsible for the loss of water from the stem of a plant.

(iii) Describe the role played by both *adhesive forces* and *cohesive forces* in the transport of water from the root to the leaves in tall trees.

(c)



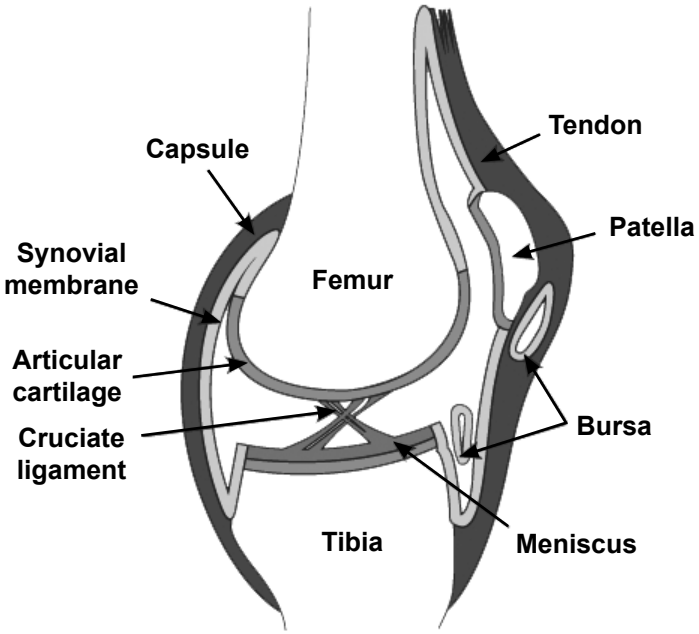
A **B**

(i) Name the type of joints shown in parts A and B of the above diagram.

(ii) Where in the body are the bones shown in part B located?

(iii) Name the biomolecule found in cartilage.

(iv) Classify the type of joint shown below, and state in which part of the body this particular joint is located.



(v) What is the function of ligaments?

(vi) Damage to the cruciate ligament is an injury often suffered by athletes. Study the diagram above and explain how you think an athlete will be affected by a torn cruciate ligament.

(vii) To what type of tissue are the tendons attached?

(viii) Apart from the presence of cartilage name **one** other feature of this joint which offers protection.