BIOLOGY TOPICAL QUESTIONS AND ANSWERS.

CLASS: FORM 2

TOPIC 2: GASEOUS EXCHANGE IN PLANTS AND ANIMALS.

1. Explain what happens when diaphragm muscles contract during breathing in mammals.

Diaphragm flattens, this increases the volume of thoracic / chest cavity, hence decreasing the pressure in the chest.

2. State **one** way in which floating leaves of aquatic plants are adapted to gaseous exchange.

They have aerenchyma cells for buoyancy.

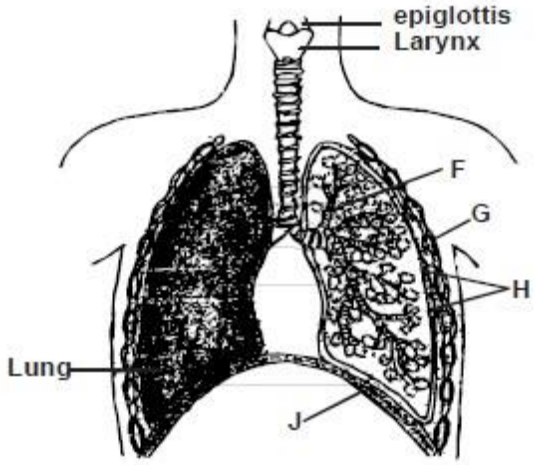
3. State **three** sites of gaseous exchange in mesophytes.

Stomata ; lenticel
;
Cuticular surface;

4. State **two** structural adaptations of the gill filaments of the bony fish.

Gill filaments/lamellae numerous provide large surface area for gaseous exchange; gill filaments are lined with a thin epithelium to facilitate faster diffusion of gases. The gill filaments are well supplied with blood capillaries (highly vascularised) to transport gases;

5. The diagram below represents part of the gaseous exchange system in human.



a).Name the parts labelled F and G. (2 marks)

F- Bronchiole;
G -Intercostal muscles;

b) State one function of each of the parts labelled H and J.

H - (Pleural Membrane) - Secretes pleural fluid to lubricate lungs/protect lungs) J - (Diaphragm) - Separates chest cavity from abdominal cavity; works to effect volume/pressure changes in chest cavity.

6. Explain why it is not advisable to be in poorly ventilated room with a burning charcoal stove.

Charcoal in limited supply of air produces carbon (ii) oxide; which combines with haemoglobin forming carboxyhaemoglobin which is stable/does not dissociate reducing capacity of haemoglobin to carry oxygen leading to suffocation hence death.

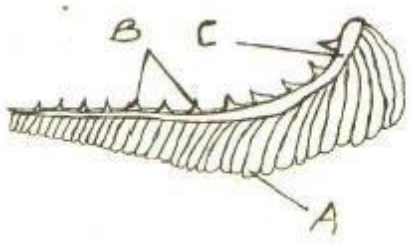
7. Name two main sites of gaseous exchange in terrestrial green woody plants.

Stomata; lenticels; cuticle,

8. Explain why respiratory surfaces in animals need to be thin and moist.

Thin – To reduce diffusion distance.
Moist –To dissolve respiratory gases.

9. The diagram below show a respiratory structure of a bony fish.



a)Name the parts labeled A, B and C

A – gill filament B – gill rakers C – gill arch/ bar

c) How is the part labeled A adapted to its function?

(i) Are numerous to increase the surface area for gaseous exchange, for faster diffusion of respiratory gases
(ii) Thin walled for faster diffusion of respiratory gases
(iii) Highly vascularized to transport the respiratory gases for faster diffusion of respiratory gases
(iv) Moist to dissolve respiratory gases for faster diffusion of respiratory gases.

10. What is the advantage of counter current flow system in fish over the parallel flow?

The counter current flow maintains a steep concentration gradient across the respiratory surface; facilitating maximum gaseous exchange between the water flowing over the gills to the blood in the gills.

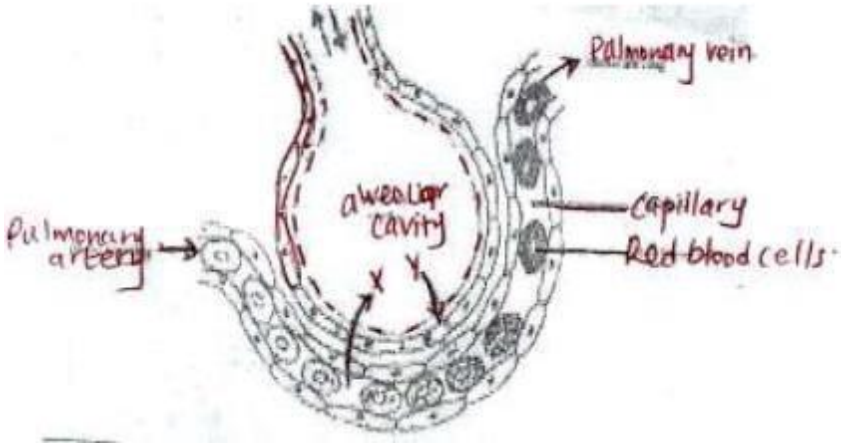
11. Explain why it is not possible to drown a locust while holding its head under water.

Air gets into the intergral parts by the spiracles.Spiracles are found in the thorax and abdomen; therefore since there are no structures for gaseous exchange on the head, it's not possible to drown it by holding head in water.

12. List the changes that take place during inhalation in the breathing cycle of mammal in the following.
    (a) Ribcage and thoracic cavity.
    Volume increases, pressure decreases; rises upwards and (slightly) outwards;
    (b) Diaphragm **Flattens.**
    (c) External intercostal muscles.
    Contracts.
    (d) Internal intercostal muscles.
    Relaxes.

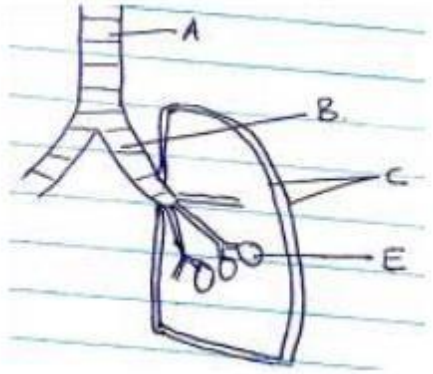
13.(i) Name the gaseous exchange surface in insects.
Tracheoles
(ii) State two ways the surface named in (a) above is suited to its function.
- **Lack chitin and are thin walled to reduce distance of diffusion of gases.**
- **Have a liquid at the tip to dissolve the diffusing gases**
- **Highly branched/divided to increase surface area for diffusion of gases.**
- **They are in direct contact with tissue cells hence increasing rate of diffusion of gases.**

14.The diagram below represents gaseous exchange in the alveolus.



Mention the path followed by gas y from alveolar space until it reaches the red blood cells.
Oxygen (gas y) dissolves into moisture layer and diffuses across the thin epithelium; then across the thinepithelium of capillary; combines with haemoglobin in red blood cells to form oxyhaemoglobin;

15. Study the diagram below and answer the questions that follow.

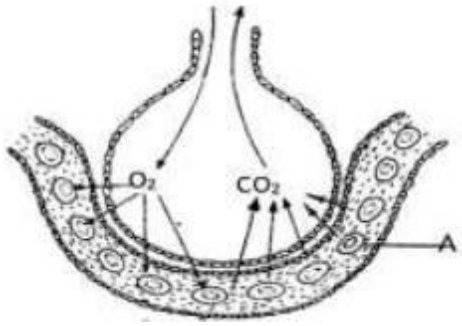


a).Name the part labeled A and B

A – trachea; B
– Bronchus;
b) State the function of the part labeled C
(Pleural membrane) secretes pleural fluid; that lubricates the lungs; c)
How is the part labeled E adapted to its function
– Sac-like/round to provide large surface area for maximum diffusion of gases;
- Moist to dissolve gases;
- Thin membrane for rapid/faster diffusion of gases;
- Well vascularized/has numerous blood capillaries to transport the gases;
d) Indentify the structure that perform the same function as one illustrated above in.
i) Amoeba --- **cell membrane** ii)
Fish ---- **gill.**

16. State THREE adaptations of a leaf to gaseous exchange.
It has stomata for efficient diffusion of gases;
It is thin to allow gases to diffuse through short distances;
It has air spaces for easy circulation of gases;
It has broad and flat lamina to provide large surface area for absorption;

17. Describe the Process of inhalation in mammals.
- External intercostals muscles contract; while internal intercostals muscles relax;
- (This movement) pulls ribs upwards and outwards;
- The diaphragm muscles contract; and the diaphragm flattens;
- (All the above movements) increases the volume of thoracic cavity; and decreases its pressure; Atmospheric pressure being
higher than thoracic cavity pressure; Forces the air to rush into the lungs; (through the nose and trachea)
- The lungs are inflated.
18. The diagram **below** shows the exchange of gases in alveolus.



(i)State how the alveoli are adapted to their function.
- Have thin film of moisture to dissolve gases for efficient diffusion;
- Have a thin epithelium for faster diffusion of gases;
- Have a large surface area for maximum gaseous exchange;
- Have a network of blood capillaries for transportation of differing gases; (ii) Name the cell labelled **A**.
Red blood cell;

19. Differentiate between gaseous exchange and ventilation.

Gases exchanger is passage of respiratory gases across the respiratory surface; while ventilation is the process of bringing in air rich in oxygen and removing out air rich in carbon (IV) oxide;

20. Most carbon (IV) oxide is transported from tissues to the lungs within the red blood cells and not in the blood plasma. Give two advantages of this mode of transport.

PH of blood plasma is not altered/homeostasis is maintained; within the red blood cells, there is enzymes (carbonic anhydrase) which help in fast loading/combination and offloading/dissociation of carbon (IV) oxide.

21. Name the part of the brain that regulates breathing.
Medulla oblongata;

22. Give two ways through which the body responds to increased concentration of carbon (IV) oxide in the blood.
Increased rate of breathing;
Increased rate of heart beat;

23. Name the structures in pneumatophores through which gaseous exchange occurs. **Lenticels;**

24. Name two structures for gaseous exchange in aquatic plants

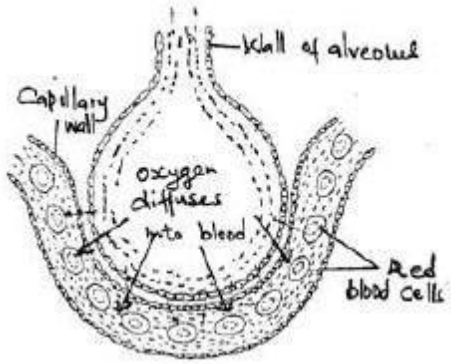
- Stomata
- Pneumatophores
- Thin cuticle

25. State the three structural adaptations of the lungs in mammals.

-Moist to dissolve respiratory gases
-Vascularized for uptake of respiratory gases
-Thin epithelium of the alveoli to reduced distance for diffusion
-Numerous alveoli to increase surface area for gaseous exchange

26. Explain why there is increased heart beat during vigorous exercise in man.
This is to remove the poisonous lactic acid produced by anaerobic respiration in muscles; and increase oxygen supply to the tissues;

27. The figure below shows an alveolus in which gaseous exchange take place.



(i).Define the term diffusion.

Process by which particles move from a region of high concentration to a region of low concentration;

(ii) What causes oxygen to diffuse into the blood from the alveoli?

High concentration of oxygen in the alveoli.

(iii) List **two** features of gaseous exchange surfaces in animals, such as humans that are evident in the diagram above.

Thin epithelium;

Rich network of blood capillaries; Moist surface.

28. How are respiratory gases, oxygen and carbon (IV) oxide transported to and from tissues in mammals?

Transport of oxygen gas.

The alveoli have a higher concentration of oxygen gas; than the blood in pulmonary capillaries; oxygen diffuses across alveoli wall, endothelium of capillaries; into red blood cells; where it combines with haemoglobin; to form oxyhaemoglobin; a compound that dissociates easily;it is then transported in this form to respiring tissues; in the capillaries of respiring tissues oxyhaemoglobin dissociates into oxygen and haemoglobin; Oxygen diffuse into tissue cells; along a concentration gradient.

Transport of carbon (IV) oxide.

High concentration of carbon (IV) oxide in the cells stimulates dissociation of oxyhaemoglobin in blood capillaries of the tissues; carbon (IV) oxide diffuses out of the cells tissue fluid, across the endothelium of tissue capillaries; into the red blood cells; where it combines with water to form a weak carbonic acid; which dissociates into hydrogen carbonate and hydrogen ions; hydrogen ions combine with haemoglobin to form haemoglobinic acid; thus pH of the red blood cells and plasma remains constant; the hydrogencarbonate ions diffuse into the plasma and are transported in this form to lungs; a little of carbon (IV) oxide is transported in the plasma in form of hydrogencarbonate ions to the lungs; in the pulmonary capillaries, carbon (IV) oxide is released from the hydrogencarbonate ions and diffuses into the alveoli along a concentration gradient ; the enzyme carbonic anhydrase in red blood cells speed up loading and off-loading of carbon(IV) oxide;

29. Explain how the Tracheoles of an insect are adapted to gaseous exchange.

– Being numerous to increase surface area over which exchange of gases occur.

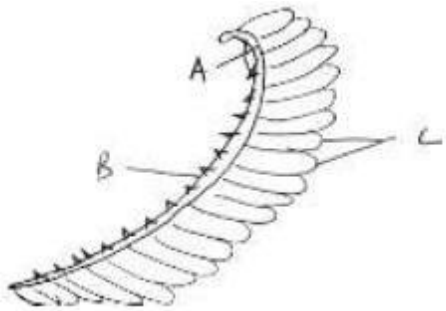
- Highly branched and spread throughout the insect body to deliver oxygen to body tissues.

- Moist to dissolve gases being exchanged.

30. Name the compound formed between haemoglobin pigment and the following gases in the human body.

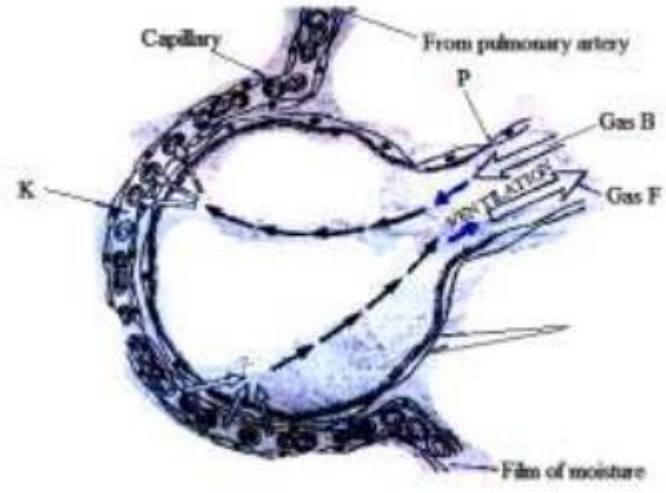
i) Carbon IV Oxide
Carbarnino haemoglobin; ii)
Carbon II Oxide.
Carboxy haemoglobin;

31.The diagram below represents a gill of a bony fish . Study it and answer the questions that follow.



Give the function of each of the lablled parts A, B and C.
A – Trap mud/solid matter in the water before passing over the delicate gill filaments.
B - Provide firm attachment for gill rakers and gill filaments.
C- Has blood vessels which carry away absorbed oxygen from the gill filaments.

32. The diagram below shows the exchange of gases in the alveolus. Study it and answer the questions that follow.



(a)Name the gases named F and B.
A - Carbon dioxide
B - Oxygen ;
(b) State the importance of the gas marked B in the tissue.
Oxygen - Needed for tissue respiration to provide energy; (c)
Name the parts marked K and P.
K – Plasma.

P - Walls of alveolus.

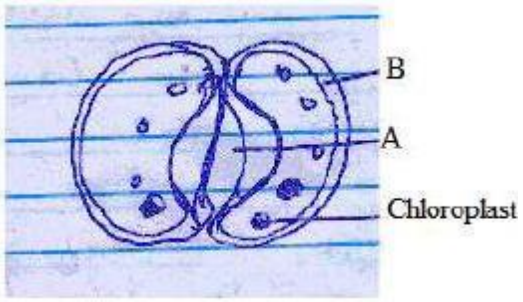
33. Discuss gaseous exchanged in alveolus.

Lungs have numerous alveoli to increases surface area for diffusion of gases; Alveoli have thin membrane which minimize resistance against diffusion of gases; Blood flowing in the capillaries contains less oxygen and more carbon (IV) oxide since it is from the body tissues; Alveoli are supplied with air through bronchioles which link them to the trachea; Alveoli are supplied with many capillaries containing blood to transport gases; Air in the alveoli contains more oxygen and combines with haemoglobin, forming oxyhaemoglobin.;Carbon(IV) oxide diffuses out of the blood into the alveoli; from where it is exhaled.

34. Describe the process of exhalation in mammals.

Internal intercostal muscles contract as external intercostal muscles relax; the ribcage moves downwards and inwards; Diaphragm muscles relax; diaphragm assumes its domesshape; Volume of the thoracic cavity decreases; resulting in decrease in lung volume. Pressure in the lungs increases; Air is then forced out of the lungs;

35. Use the diagram of the stoma below to answer the questions that follow.



(a) Identify parts labelled A and B.

A - Stoma rej stomata

B - Outer wall

b).State the functions of the structure shown in the diagram above.

Gaseous exchange; loss of water in form of water vapour ;

36. Explain why a cross-circuit athlete pants heavily after sprint race.

Incurs shortage of oxygen during the race; a lot of oxygen required to oxidize lactic acid produced; (during strenuous exercise).

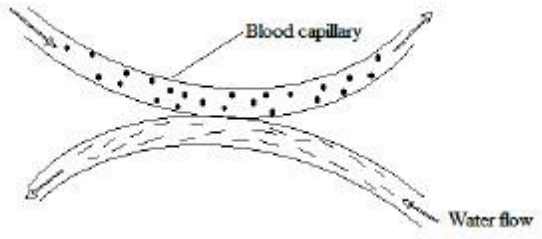
37. Describe the path taken by carbon (IV) oxide released from the tissue of an insect to the atmosphere.

Carbon (IV) oxide In the tissue diffuses to the tracheoles;diffuses to the trachea; then the Spiracle open to atmosphere;

38. Describe the function of the red blood cells in gaseous exchange.

- **Red blood cells contain haemoglobin *;* which has a high affinity for oxygen. Haemoglobin combines with oxygen in areas of high oxygen concentration to form oxyhaemoglobin which is transported to cells in areas of low oxygen concentration*;***
- **Haemoglobin also combines with carbon (IV) oxide forming carboxyhaemoglobin*;* hence transporting it to the lungs for removal out of the body*;***
- **Red blood cells are bincave in shape*;* to increase surface are for diffusion of oxygen and carbon (IV) oxide*;***
- **Mature red blood cells lack a nucleus*;* and other cell organelles. This creates adequate space for packing of haemoglobin*;***
- **Red blood cells contain enzyme carbonic anhydrase with catalyses the reaction between water and carbon (IV) oxide to form carbonic acid*;***
- **Haemoglobin reacts with hydrogen ions from the dissociation of carbonic acid thus buffering the plasma pH*;***
- **Red blood cells are numerous to ensure efficient transport of oxygen to the respiring tissues and carbon IV oxide from the tissues.**

39. The diagram below illustrates the flow of blood and water within the respiratory surface in fish.



(a)Name the term used for this arrangement.

Counter - current flow (system) ;

(b)Explain the significance of the arrangement.

This ensure efficient diffusion of oxygen from water into blood i.e there is continuous diffusion of oxygen from water into blood ; Eventually blood that leaves the gills has almost the same concentration of oxygen as the water that enter the gills /maintains a steep diffusion gradient between water and blood ;

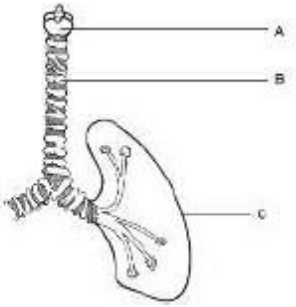
40. State **two** structural adaptations of the gill filaments of the bony fish.

Gill filaments/lamellae numerous provide large surface area for gaseous exchange; gill filaments are lined with a thin epithelium to facilitate faster diffusion of gases. The gill filaments are well supplied with blood capillaries (highly vascularised) to transport gases;

41. Name two main sites of gaseous exchange in terrestrial green woody plants. **Stomata; lenticels; cuticle,**

42. Explain how mammalian lungs are adapted for gaseous exchange.
-Surrounded by pleural membranes; to protect them from mechanical damage.
-Spongy and elastic; for contraction and relaxation hence allowing inflation and deflation. -The pleural membranes secrete pleural fluid; that prevents them from friction with inner wall of thorax during inhalation and exhalation.
-Has numerous alveoli; to increase surface area for gaseous
-Highly vascularised /many blood capillaries; for faster transportation of respiratory gases.
-Contained in the thoracic cavity that is spacious; for excellent ventilation.
-Alveoli have thin epithelium; for fast diffusion of gases.
-Alveoli living are moist; for dissolution of respiratory gases.
-Have macrophages; that engulf and destroy any microorganisms that were not filtered in the respiratory passages.
-Its alveoli have surfactant fluid on the epithelial lining; that prevents their collapse during exhalation.

43.The diagram below shows part of the human breathing system.



(a)Name the parts labelled **A** and **C**.
A-Larynx.
C- Pleural membrane.
b).State one function of the part marked **B**. **Allows passage for the respiratory gases.**

44. Name the tissue in the stem and leaves of hydrophytes that allows them to store air for gaseous exchange.
Aerenchyma tissue;
45. State the function of pneumatophores.
Breathing roots/has lenticles that are used for gaseous exchange by halophytes; 46. Why is gaseous exchange important to organisms?
- to supply oxygen necessary for energy production - to remove carbon IV oxide produced during respiration - To remove Water vapour.

47.What is gaseous exchange?

The continuous exchange of oxygen and carbon Iv oxide between the organism and environment

48. Briefly describe the structure of stomata.

- **Are minute pores found in leaf epidermis**
- **Each consists of a slit-like opening**
- **Each is bordered by two large, bean-shaped guard cells.**
- **Guard cells contain chloroplasts, unlike the other epidermal cells which enable photosynthesis to occur.**
- **Inner walls of guard cells are thicker than the outer cells.**

49.State the factors which affect stomatal opening

- **Water which when low stomata close and when high stomata keeps open. - Light as stomata open in bright light and close in darkness - Temperature.**

50. Describe the mechanism of opening and closing of stomata.

- **Stomata close at night and open during daytime**
- **This comes about due to changes in turgidity as a result of pH changes in guard cells.**
- **In the dark carbon Iv oxide accumulates in the intercellular spaces**
- **This raises concentration of carbonic acid**
- **The pH drops (pH lowered)**
- **Enzymes convert sugar into starch in guard cells**
- **Osmotic pressure in guard cells is lowered**
- **Water moves out of guard cells by osmosis making cells lose turgidity hence become flaccid - The stomata close**
- **During day time there is photosynthesis hence the production of sugar, carbon IV oxide concentration is lowered, pH increases, guard cells become turgid causing stomata to open.**
- **During the day potassium ions concentrate in guard cells, raising their osmotic pressure and causes then to open**
- **In the night the concentration of potassium ions decreases increasing osmotic pressure in guard cells therefore causes stomata to open.**

51.What is the advantage of having stomata open during daytime and having them closed at night?.

- **Opening in the daytime allows diffusion of carbon IV into the leaf for photosynthesis to take place and allows diffusion of oxygen out of the leaf - transpiration also takes place, thus cooling the leaf and facilitating uptake of water and mineral slats**

- **Closing in the night is to conserve water in the plant especially when there is not enough water available in the soil.**

52. State the ways in which leaves of plants are adapted to gaseous exchange.

- **Presence of stomata for faster gaseous exchange**
- **intercellular spaces/air spaces in the leaf for movement/circulation of air**
- **Film of moisture around the surface of cells for easy diffusion**
- **Broad/flattened shape to increase surface area - Thin lamina to reduce distance of diffusion - Exposed to air for easy diffusion.**

53. Describe how gaseous exchange takes place in terrestrial plants.

- **Gaseous exchange takes place in spongy mesophyll**

-During the day air diffuses into large air spaces of spongy mesophyll through stomata

- **The carbon iv oxide in the air diffuses into the photosynthesis oxygen is produced**
- **Some of the oxygen diffuses out of the leaf through stomata**
- **During the night air diffuses out of air spaces of spongy mesophyll**
- **The air dissolves into film of moisture**
- **The oxygen in the air diffuses into cells and is used in respiration during which carbon iv oxide is produced**
- **The carbon iv oxide diffuses out of the leaf through stomata due to diffusion/concentration gradient**
- **At night carbon iv oxide accumulates in the leaf since photosynthesis does not take place**
- **Some gaseous exchange also takes place through cuticle**
- **Gaseous exchange occurs through epidermis of young leaves and stems**
- **The cork cells at lenticels are loosely packed**
- **Gaseous exchange takes place between cork and atmosphere within the loosely packed cell**

54.State the ways in which floating leaves of aquatic plants are adapted to gaseous exchange.

- **Stomata found only on upper dermis to allow efficient gaseous exchange.**
- **Presence to aerenchyma tissues/large air spaces to enable it**

float/buoyancy/storage of air.

- **Absence of cuticle to enhance gaseous exchange.**

55.How is aerenchyma tissue adapted to its function?.

Has large airspaces which store gases/for gaseous exchange/buoyancy.

56.List FIVE types of respiratory surfaces of animals.

- **Cell membrane in unicellular organisms e. g. amoeba.**
- **Gills in fish.**
- **Tracheal system.**
- **Skin, buccal cavity and lungs in amphibians. - Lungs in mammals.**

57. Describe gaseous exchange in protozoa**.**

- **An example of a protozoa is amoeba.**
- **It is small and have a large surface area.**
- **Oxygen diffuses into the organism and carbon IV oxide diffuses out into Water.**
- **Simple diffusion of gases is enough to meet its respiratory requirements.**

58.What is counter-flow system?.

Where water in which the fish lives flows in opposite direction across the gill.

59. Discuss gaseous exchange in bony fish.

- **Example is tilapia**
- **the mouth opens and the floor of the mouth is lowered so that the volume in the mouth is increased and pressure is lowered**
- **water then enters into the mouth cavity**
- **the mouth is closed and the floor of the mouth raised so that the volume is reduced this raises the pressure, forcing water over gills and out through the operculum**
- **As water passes over the gills oxygen diffuses due to concentration gradient (partial pressure) into the blood stream.**

- **In the body tissues, carbon IV oxide diffuses into the blood (due to concentration gradient, and is transported to the gills and diffuses out into the water.**

60. Describe the mechanism of gaseous exchange in terrestrial insects.

- **example is cockroach**
- **air in the atmosphere contains oxygen**
- **air is drawn into the body of the insect through the spiracles due to movement of abdominal muscles**
- **these movements cause the opening of spiracles**
- **air moves through the trachea to tracheoles**
- **oxygen moves from the tracheoles into body cells by diffusion due to concentration gradient**
- **carbon iv oxide in the tissues diffuses into tracheoles due to concentration gradient**
- **From tracheoles carbon IV oxide moves into trachea and out through the spiracles into the air.**

61. What is breathing?.

Any process which speeds up the rate of gaseous exchange between an animal and its surrounding.

62. How is the trachea of a mammal suited to its function?

- **has a ring of cartilage which keeps it open at all times.**
- **cilia that move mucus/particles to the top of the trachea i.e. into larynx for removal.**
- **mucus to trap dust, solid particles and microorganisms - hollow for passage of air.**

63. State the advantages of breathing through the nose rather than through the mouth.

- **Nose has hairs to filter solid particles.**
- **It has mucus lining to trap dust particles.**
- **The nose has cells sensitive to smell for survival.**
- **It warms the air before it reaches the lungs.**

64. Give the conditions under which the carbon iv oxide level rises above normal in mammalian blood.

- **vigorous exercise.**
- **Emotions/stress.**
- **Disease infection.**

65. Explain the physiological changes that occur in the body to lower the carbon iv oxide level back to normal when it rises.

- **Heartbeat/cardiac frequency increases to pump blood faster carbon iv oxide from the tissues and supply more oxygen**

- **Ventilation rate/rate and depth of breathing increases to take more oxygen and remove carbon iv oxide from the lungs**
- **Arterioles to take in more oxygen and remove carbon iv oxide from the lungs - Arterioles dilate leading to faster flow of blood to and from body tissues.**

66. Describe the factors which control the rate of breathing in humans.

- **Breathing movements usually occur unconsciously.**
- **It is controlled by the medulla oblongata part of the brain situated at the breathing centre.**
- **Medullar oblongata is in the brain.**
- **Respiratory centre transmits impulses to the diaphragm through phrenic nerves.**
- **Carbon iv oxide concentration in the blood determines the breathing rate.**

- **If carbon iv oxide is less, the brain is triggered to decrease breathing rate.**
- **Cardiac frequency decreases and the arterioles constrict.**
- **Therefore carbon iv oxide level is raised.**
- **This brings back to normal level of breathing and carbon iv oxide level increases/is more.**
- **The brain is triggered to increase breathing rate.**
- **Cardiac frequency is increased.**
- **There is vasodilation of arterioles.**
- **Carbon iv oxide level falls.**
- **Therefore the normal level is attained and carbon iv oxide is removed faster.**

67. List the respiratory diseases.

- **Asthma.**
- **Bronchitis.**
- **Whooping cough.**
- **Pneumonia.**
- **Tuberculosis.**

68. Explain the use of oxygen in the living cells.

The living cells uses energy to carry out the process of respiration,which leads to production of energy.

69. Describe how carbon (iv) oxide produced by the respiratory liver cells reaches the alveoli cavities in the mammalian lungs.

From the liver cells, the carbon (iv) oxide diffuses in to the surrounding blood capillaries, In the blood, it dissolves in the red blood cells cytoplasm to form weak carbonic acid while some dissolves in the plasma to form carbonic acid while the rest combine with haemoglobin to form carbaminohaemoglobin.It is the transported in this forms to the hepatic venule, which unite to form hepatic vein. From the hepatic vein it is then transported to inferior vena cava then to the right atrium, later to the right ventricle via the bicuspid valve, from where it is pumped out through the pulmonary artery to the lungs. The pulmonary artery branches to pulmonary arteriole and further to capillaries which take up the blood with carbon (IV) oxide near the alveoli in the lungs, Carbon (iv) oxide then diffuses through the thin epithelia of the blood capillaries and alveoli, into the alveolar cavity.

70. Name the gas released by plants to the atmosphere at night. **Carbon (iv)oxide.**

71. What is the effect of dust on gaseous exchange in terrestrial plants.

Dust particles blocks the stomata and lenticels stopping gaseous exchange.