Must know questions <3

1. **Describe what happens to a fertilised egg in its early development.**
    a. The zygote undergoes mitosis to form daughter cells which are called embryo.
    b. The embryo implants in the uterine lining.
    c. Finger-like projections called villi grow from the embryo into the uterine lining. They contain blood capillaries of the embryo. The villi and the uterine lining make up the placenta.
    d. Amniotic sac will enclose the embryo. Amniotic fluid fills the amniotic sac.
    e. The umbilical cord attaches the fetus to the placenta. The two umbilical arteries transport deoxygenated blood and metabolic waste products from the fetus to the placenta. The umbilical veins transport oxygenated blood and food substances like glucose from the placenta to the fetus.

2. **Describe how meiosis leads to the formation of new genetic combinations.**
    a. Formation of gametes involves meiosis
        i. Crossing over of chromatids of homologous chromosomes in prophase I of meiosis.
        ii. Formation of new combinations of alleles in prophase I.
        iii. Independent assortment of chromosomes at metaphase I.
    b. Random fertilisation

3. **How does a gene mutation lead to the production of a new enzyme/hormone/protein?**
    a. Changes in DNA, base sequence
    b. Change in sequence of nucleotides
    c. Control production of a specific polypeptide
    d. Change in sequence of amino acids

4. **Compare breathing and respiration.**
    a. Breathing is moving air into and out of the lungs but respiration is the release of energy from food.
    b. Breathing is a physical process of exchange of gases but respiration is a chemical process that takes place in living cells.

5. **Describe the processes after exercise.**
    a. Continue to breathe at a high rate to provide enough oxygen to pay off the oxygen debt.

b. Continue to have a high pulse rate to provide enough oxygen to pay off the oxygen debt.
c. Lactic acid is transported from the muscles to the liver where lactic acid is broken down.

6. **Differentiate between a reflex action and a voluntary action.**
    a. A reflex action is faster than a voluntary action
    b. A reflex action is an unconscious control but a voluntary action is a conscious control.
    c. Reflex action is automatic but voluntary action is not automatic.
    d. Reflex action begins with the receptor being stimulated however voluntary action begins with a decision from the brain.
    e. Reflex action will always involve the sensory neurons however voluntary action may or may not involve the sensory neuron.
    f. Both involve the transmission of nerve impulses.
    g. Both involve motor neurons transmitting nerve impulse to the effector.

7. **Suggest what causes the fall in blood pressure when the blood passes from the aorta to the vena cava.**
    a. Aorta and arteries have thicker muscular walls as compared to veins. Capillaries have no muscle tissue in the wall. There will be greater recoil of the vessel wall in the artery than compared to the veins. There is no recoil of the capillary wall.
    b. Aorta and arteries have smaller lumen relative to diameter as compared to capillaries and veins. This causes loss of blood pressure as blood moves from smaller cross sectional area to larger cross sectional area in the capillaries and the veins.
    c. The loss of pressure due to friction from arteries to capillaries than veins.

8. **Explain how exercise causes a fall in the blood glucose concentration.**
    a. Muscle cells undergo a higher rate of aerobic respiration. More glucose oxidised to release more energy for muscular contractions.
    b. Hence more glucose needed hence more glucose uptake from the blood into muscle cells.
    c. Hence blood glucose concentration in blood falls.
9. **Suggest what is meant by metabolic water.**
    a. It is the water produced from chemical processes that take place in living cells.

10. **ADH is involved in the prevention of dehydration. Explain how ADH reduces water loss from the body.**
    a. Dehydration means there is a lower water potential in the blood.

b. The pituitary gland will release more ADH
c. ADH makes the walls of the collecting duct more permeable to water
d. More water is reabsorbed from the collecting duct into the surrounding blood capillaries
e. This will return the water potential of blood to normal.

11. A person is only able to produce low levels of carbonic anhydrase. Suggest and explain the effect of this deficiency on gas exchange in this person.

a. In the respiring tissues, there is less carbonic anhydrase in the red blood cells and this leads to less conversion of carbon dioxide and water to form carbonic acids.
b. At the lungs, lesser carbonic anhydrase in the red blood cell leads to lesser conversion of carbonic acid to form carbon dioxide and water.
c. More carbon dioxide accumulates in the body tissues.
d. Lesser carbon dioxide will diffuse out of the blood into the alveolar cavity to be exhaled.

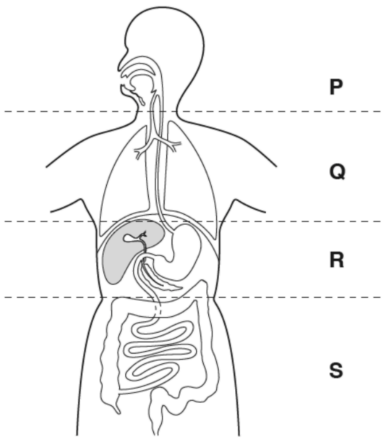
12. Suggest a possible nutritional advantage to the young cow of the action of rennin.

a. A young cow's stomach is small. Rennin causes milk to curdle and form lumps.
b. Milk is retained in the stomach for a longer time
c. For protease to digest the protein in milk.

13. With reference to the movement of substances in a neuron, describe how salts are reabsorbed in the kidney.

a. At the proximal convoluted tubule, most mineral salts and glucose are reabsorbed into the surrounding blood capillaries.
b. If the concentration of mineral salts and glucose is higher than the blood, diffusion of mineral salts and glucose occurs.
c. If the concentration of mineral salts and glucose are lower in the blood, active transport occurs.
d. Energy from respiration is used.

14. Compare and contrast the movement of air and food in region Q.



Air: inhale and exhale through the trachea, bonchi, bronchioles and into the alveoli. Pressure changes.

Food: peristalsis and oesophagus

Rhythmic contraction of the circular muscles and longitudinal muscles. Circular muscles contract and longitudinal muscles relax → food is pushed forward.

15. Describe the cause of Down's syndrome.

- Chromosome mutation
- Child has one more copy of chromosome 21

16. Describe the cause of sickle-cell anemia.

- Genetic mutation
- Recessive allele
- Inherited 2 recessive alleles / homozygous recessive.

17. Explain how the 'lub' and 'dub' sounds are generated in the heart.

- "Lub": closing of AV valves / bicuspid and tricuspid valves
  - When pressure in the ventricles rise
- "Dub": closing of semi-lunar valves
  - When the pressure in the aorta rise

18. Explain how a named hormone can cause the rise in heart rate.

- Adrenal gland secretes adrenaline into the bloodstream
- Adrenaline carried to the target organs in the bloodstream.
- Stimulates liver cells to convert glycogen to glucose
- More glucose in bloodstream
- More glucose and oxygen brought to respiring cells
- Higher rate of aerobic respiration
- More energy released

19. Explain, with reference to human blood groups, what is meant by codominance and multiple alleles.

- Codominance results when 2 alleles controlling the same trait both expressed themselves in the organism.
- Multiple alleles is a term used for the **same** gene that exists in more than two alleles.
- There are 3 alleles controlling the blood group. IA, IB, IO.
- IA and IB are dominant over IO
- IA and IB exhibit codominance
- Genotype IAIO and IAIA will be blood group A
- Genotype IBIO and IBIB will be blood group B
- Genotype IOIO will be blood group O
- Genotype IAIB will be blood group AB.

20. Define discontinuous variation.

Discontinuous variation deals with a few clear cut phenotypes. It is controlled by one or a few genes.

21. Define a gene.

A gene is a unit of inheritance, a sequence of nucleotides, and is a part of DNA. It codes for the production of a specific polypeptide.

22. Define alleles.

An allele is a different form of the same gene. They occupy the same relative position on a pair of chromosomes.

23. Smoking tobacco can cause the occlusion of coronary arteries.
Suggest the effects of occluding coronary arteries.

- Decreased flow of blood with oxygen and glucose to the heart muscles.
- Reduced rate of aerobic respiration in heart muscle cells and hence less energy released.
- Heart rate decreases
- Less blood with oxygen and glucose pumped to the body tissues.
- Reduced rate of aerobic respiration in body tissues
- Fatigue!

24. Suggest a role for the muscle fibres in small arteries.

- Larger proportion of muscle fibres in the small artery wall
- Muscles contract and relax to bring about constriction and dilation of the artery.
- Small arteries help to regulate the temperature. Arterioles in the skin dilate to allow more blood to flow to the skin surface to lose more latent heat of vapourisation.

25. Explain why arteries have a thick elastic layer.

- Arteries withstand high blood pressure that is forced out of the heart
- Thick elastic arteries allow the artery wall to stretch and recoil, helping to push blood along the artery.

26. In one part of the world, eucalyptus trees have evolved to resist fires.
Explain how these trees have evolved to resist fires.

- Fire is the force of natural selection,
- Nature selects the trees that are resistant to the fire to survive and reproduce their own kind.
- The other varieties that are not resistant to fire will die.
- Mutations has provided new genes and lead to greater genetic variations for natural selection to operate on.
- After millions of years, the beneficial quality of resistance to fire will accumulate in the species.

Structure:

1. ____ is the force of selection.
2. Nature selected the ____ to survive and reproduce their own kind.
3. The other varieties which _____ will die.
4. Mutations have provided **new genes and lead to greater genetic variation for natural selection to operate on**.
5. **After millions of years**, the beneficial qualities of _____ will **accumulate in the species.**

27. Describe how a blood clot is formed.

- Damaged tissues and platelets produce thrombokinase.
- thrombokinase then catalyses the conversion of prothrombin to thrombin.
- Thrombin then catalyses the conversion of fibrinogen to insoluble fibrin
- Fibrin then forms a mesh and traps the red blood cells to clot the blood.

28. Describe how the breakdown products of excess amino acids are transported in the blood from their site of production to their site of removal from the human body.

- Excess amino acids are deaminated to form urea in the liver.
- Urea is carried to the blood plasma.
- Urea is transported out of the liver via the hepatic portal vein to the vena cava to the heart.
- Heart muscles contract to pump blood containing urea all around the body
- From the heart, blood with urea is transported to the hepatic artery to the kidney.
- High hydrostatic pressure at the glomerulus forces small molecules like urea out of the glomerulus into the Bowman's capsule, forming the filtrate.
- Urea is not selectively reabsorbed from the other parts of the nephrons.
- Urea flows along the kidney tubule to the ureter to the urinary bladder.
- Urea is excreted through the urethra.

29. Explain, using a named example, what is meant by an endocrine gland.

- An endocrine gland is a ductless gland
- It secretes the hormones directly into the bloodstream.

- For example, the Islets of Langerhans
    - Produces insulin and glucagon
    - When blood glucose concentration is higher than normal, the Islets of Langerhans secrete more insulin to the bloodstream.
    - Insulin will be transported to the target organs where it exerts its effects

30. State the circumstances under which anaerobic respiration occurs in humans and the effects of the process on muscle cells.

- During vigorous exercise, the muscle cells carry out a higher rate of aerobic respiration.
- This leads to a drastic decrease in oxygen content in muscle cells.
- When the energy supply from the anaerobic respiration is not enough to meet energy demand needed for exercise,
- and oxygen supply to the muscle cells are lower than expected,
- Anaerobic respiration will occur to release more energy to meet the extra energy demand.
- Anaerobic respiration will breakdown glucose in the absence of oxygen to form lactic acid
- Lactic acid will accumulate and lead to muscle fatigue.

31. Describe the function of a nephron.

- Nephrons are in the kidney which is an excretory organ removing urea, excess mineral salts and excess water from the blood.
- At the renal corpuscle, ultra-filtration occurs.
- The high hydrostatic pressure at the glomerulus forces water and small molecules out of the basement membrane into the Bowman's capsule, forming the filtrate.
- At the proximal convoluted tubule, most of the mineral salts, all the glucose and all the amino acids are reabsorbed into the surrounding blood capillaries via diffusion and active transport. Most of the water in the filtrate are reabsorbed by osmosis.
- At the loop of henle, the distal convoluted tubule and collecting duct, some water is reabsorbed through the walls of the tubules into the surrounding blood capillaries.
- Excess water, excess salt and urea are not reabsorbed from the nephron to the blood capillaries.
- They form part of the concentrated filtrate which is passed from the ureter to the

bladder to be stored temporarily as urine before passing through the urethra.

32. When a person suffers kidney failure, they undergo dialysis. Describe the mechanism of kidney dialysis.

- Blood is drawn from the vein in the patient's arm and pumped through the tubing into the dialysis machine.
- The tubing is bathed in dialysis fluid. The walls of the tubing are partially permeable.
- Dialysis fluid has the same concentration of glucose, amino acids and mineral salts as normal healthy blood. When the patient is lacking in them, they can diffuse into the blood down a concentration gradient.
- The fluid does not contain metabolic waste products like urea. This is to set up a steep concentration gradient for urea to diffuse from the patient's blood into the dialysis fluid.
- The blood and dialysis fluid flow in counter-current. This is to maintain a steep concentration gradient for faster diffusion of molecules.
- The tubing in the machine is narrow, long and coiled. This increases the surface area to volume ratio which helps to speed up the rate of exchange of substances between the patient's blood and the dialysis fluid.
- The filtered blood is then returned to the patient.

33. Describe how homeostatic control of glucose occurs in the human body.

- Islets of Langerhans in the pancreas detect the change in blood glucose concentration from normal set point.
- When blood glucose concentration is below normal set point,
    - Islets of langerhans secrete more glucagon
    - More glucagon in the bloodstream, more glucagon in the liver
    - Glucagon stimulates the conversion of glycogen to glucose.
    - Glucagon also stimulates the conversion of fats, amino acids and lactic acid into glucose.
    - This will cause the blood glucose concentration to return to normal
- When blood glucose concentration is above normal set point
    - Islets of langerhans secrete more insulin
    - More insulin in the bloodstream, more insulin in the liver
    - Insulin stimulates the conversion of excess glucose to glycogen.
    - Insulin also stimulates the increase in permeability of glucose

34. Describe the process of photosynthesis.

- Photosynthesis occurs in the palisade mesophyll cells and spongy mesophyll cells and guard cells.
- These cells contain chloroplasts, which contain chlorophyll
- Chlorophyll traps light energy and converts them to chemical energy
- During photosynthesis, carbon dioxide and water are converted into glucose and oxygen.
- Chemical energy is stored in glucose.

35. Explain why the rate of photosynthesis is faster on a warm day than on a cold day.

- Photosynthesis involves enzymes
- Temperature is a limiting factor of photosynthesis
- At a higher temperature, the reactants have higher kinetic energy
- Frequency of effective collision increases, more enzyme substrate complexes formed per unit time

36. Describe the functions of the placenta during pregnancy.

- The placenta allows oxygen and dissolved food substances such as glucose to diffuse from the mother's blood to the fetal blood.
- Allows metabolic water or excretory products such as urea and carbon dioxide to diffuse from the fetal blood to the mother's blood.
- It allows protective antibodies to diffuse from the mother's blood to the fetal blood.
- Produces progesterone to maintain the thickness of the uterine lining in a healthy state during pregnancy.

37. Define homeostasis.

- Homeostasis is the maintenance of a constant internal environment.
- This would mean that the composition of the body fluids are kept within narrow limits.
- Examples include blood glucose concentration, blood temperature.

38. Describe the structure of DNA.

- Basic unit of DNA is a nucleotide.
- Each nucleotide is made of a deoxyribose sugar, a nitrogen containing base, and a phosphate group. There are 4 nitrogen containing bases. (Guanine, Cytosine, Adenine, Thymine)

- The nucleotides join together to form a polynucleotide.
- 2 antiparallel polynucleotides form a DNA molecule.
- The bases of one chain are bonded to those of the opposite chain.
- According to the rule of base pairing, Guanine always pairs with cytosine and thymine always pairs with adenine.
- Complementary bases are joined together by hydrogen bonds.
- DNA twists to form a double helix structure.

39. Explain how a transgenic organism can be produced.

- Cut the gene of interest with a restriction enzyme. This produces sticky ends.
- Cut a plasmid with the same restriction enzyme. This produces complementary sticky ends to the gene of interest.
- Mix the gene of interest with the plasmid. They will bind by the rule of complementary base pairing.
- Add DNA ligase to seal the gene to the plasmid. This is the recombinant plasmid.
- Add the recombinant plasmid to E.coli and apply temporary electric shock to allow the recombinant plasmid to enter the bacterium.
- Grow the bacteria in a fermenter with 37 0C, well aeration and good nutrients.

40. Define excretion and explain its importance.

- Excretion is the removal of metabolic waste and toxic substances from the body.
- Accumulation of waste products of metabolism can be toxic.

41. Describe the properties of enzymes.

- Complex protein
- Biological catalysts / lowers activation energy
- Remains chemically unchanged at the end of every reaction
- pH and temperature sensitive
- Specific in action (Lock and Key Hypothesis)

42. Describe the pathway of nerve impulses in a named reflex action.

- Pupil Reflex
- When there is a slight increase in light intensity, the receptor, retina, is stimulated and detects the change.
- Nerve impulses generated

- Sensory neurons transmit nerve impulses to the brain.
- The nerve impulses transmitted across the synapse to the relay neuron to the motor neurone.
- Nerve impulses will be transmitted to the effector, the iris muscles
- Circular muscles of the iris contract, radial muscles of iris relax, pupil constricts, less light enters the eye.

43. Describe the role of white blood cells in protecting the body from diseases.

- Lymphocytes produce antibodies which destroys bacteria by attaching to them
- Phagocytes engulf foreign particles such as bacteria.