

ZNOTES.ORG

UPDATED TO 2022 SYLLABUS

CAIE AS LEVEL
BIOLOGY (9700)

SUMMARIZED NOTES ON THE TOPICAL QUESTIONS SYLLABUS

1. Cell Structure Topical MCQs

1. One of the smallest viruses is the polio virus, which has a diameter of approximately 30 nm. In 2003, the *Mimivirus* was discovered which has a diameter of approximately 680 nm. In 2013, the *Pandoravirus* was discovered which has a diameter of approximately 1000 nm. Which row correctly matched the cell structure with a virus that has a similar approximate size?

	polio virus	<i>Mimivirus</i>	<i>Pandoravirus</i>
A	lysosome	nucleolus	nucleus
B	nucleolus	lysosome	mitochondria
C	nucleolus	mitochondria	lysosome
D	ribosome	lysosome	mitochondria

Correct answer: D

Explained solution: The size of organelles given goes as follows: ribosome < lysosome < nucleolus < mitochondria < nucleus. The easiest way to solve questions such as this is to memorize the approximate size.

2. Which size of ribosome is found in the chloroplast?

- A) 60S
- B) 70S
- C) 80S
- D) 90S

Correct answer: B

Explained solution: While eukaryotic cells have the bigger 80S ribosomes, the chloroplast and mitochondria are exceptions. They have the 70S ribosomes found in prokaryotic cells.

3. Which cell structure contains cytoplasm?

- A) Chloroplast
- B) Mitochondria
- C) Plasmodesmata
- D) Smooth Endoplasmic Reticulum

Correct answer: C

Explained solution: The plasmodesmata is a cytoplasmic route for water and mineral ion movement. It is made entirely of cytoplasm.

Cell Structure Topical Theory Questions

What features show that the given electron micrograph is from the transmission electron micrograph? [2]

1. Higher magnification, higher resolution than light microscope
2. Images is in 2D/ no surface contours
3. Organelle ultrastructure can be seen (give named examples such as internal structure of chloroplast)
4. Very thin section

Advantages of using light microscope instead of electron microscope [3]

1. Can observe living tissue and living processes
2. Different types of stains can be used to observe specific tissue
3. Portable and easy to move
4. Colour can be seen
5. Lower costs and maintenance

2. Biological Molecules Topical MCQs

1. What occurs during the formation of a glycosidic bond between 2 alpha-glucose molecules?
 - A) A 1,4 bond is always formed
 - B) A hydrogen bond is always formed
 - C) A molecule of water is always formed
 - D) A hydroxyl group (OH) is always formed

Correct answer: C

Explained solution: The formation of any glycosidic bond is through a condensation reaction hence water is always lost. Option A is incorrect because a 1,2 bond could be formed (eg. in sucrose). Option B is incorrect because there may be cases where H-bonds are formed but they are not always formed.

2. A solution of amylase was added to a suspension of starch. After 30 seconds, three samples of the mixture were tested with iodine solution, Benedict's solution or biuret reagent. Which are the expected results?

	Iodine Solution	Benedict's Solution	Biuret Reagent
A)	black	green	purple
B)	black	red	blue
C)	brown	blue	purple
D)	brown	yellow	blue

Correct answer: A

Explained solution: Amylase is an enzyme hence it is a protein. Amylase will cause starch to breakdown to glucose or fructose so the solution will contain protein, starch, and low concentration of reducing sugars. Option A contains a positive result for presence of all three types biological molecules.

3. Which statement about the properties of water is correct?
- A) Bonds between hydrogen atoms cause the water to have a high specific heat capacity
 - B) The latent heat of vaporisation of water is due to the presence of hydrogen bonds
 - C) The high specific heat capacity of water causes cooling during evaporation
 - D) Water can dissolve amylopectin as it has hydrophilic side chains.

Correct answer: B

Explained solution: Water has a very high latent heat of vaporisation meaning that it requires a lot of energy to convert water from a liquid state to a gaseous state. This is mainly due to the presence of very strong hydrogen bonds.

Biological Molecules Topical Theory Questions

Explain how amino acids can be close together in an active site by explaining structure of protein.

1. Further coiling and folding of polypeptide chain
2. Giving tertiary structure
3. Held in position by R group interaction
4. Brings distant amino acid close

What is the effect of replacing glutamine (polar) with valine (non-polar) in alpha/beta globin?

1. Glutamine is polar and valine is non-polar
2. Change in tertiary shape
3. Change in quaternary structure of haemoglobin
4. Haemoglobin less soluble
5. Haemoglobin is less efficient at transporting oxygen

Describe the hydrogen bonding that occurs between water molecules

1. Hydrogen bond is a weak bond between oxygen atom of 1 H₂O molecule and the hydrogen atom of another H₂O molecule
2. Oxygen is highly electronegative more than H
3. Oxygen has two lone pairs so it can form 2 hydrogen bonds
4. Asymmetrical electron distribution
5. Oxygen has delta + and hydrogen has delta - charge

3. Enzymes Topical MCQs

1. The enzyme trypsin hydrolyses proteins to amino acids. Trypsin does not function when the pH is very

low as its 3D shape would be changed. What explains this change in 3D shape?

- A) Hydrogen ions attach themselves to negatively charged R groups
- B) Hydrogens ions disrupt disulfide bonds
- C) Hydrogens ions increase hydrogen bonding between amino acids
- D) Hydrogen ions reduce the affinity of hydrophilic R groups for water

Correct answer: A

Explained solution: A low pH results in a high concentration of H⁺ ions. The H⁺ ions act on the active site of the enzyme and interact with the R groups to change the bonding of the R groups hence denatures the enzyme. So the correct answer is A.

2. The enzyme beta-galactase can catalyse the hydrolysis of four substrates with similar structures. Each substrate gives a different K_m value. For which substrate does the beta-galactase have the highest affinity?

	Substrate	K _m (mol/dm ³)
A)	1	0.004
B)	2	0.001
C)	3	0.0002
D)	4	0.0001

Correct answer: D

Explained solution: The K_m is inversely proportional to the affinity hence lower the K_m, higher the affinity so the answer is D.

Which features are correct for a competitive inhibitor of an enzyme-catalysed reaction?

	binds to active site	changes shape of enzyme	similar shape to substrate	rate of reaction affected by concentration of inhibitor	
A	✓	x	✓	✓	key ✓ = correct x = incorrect
B	✓	x	x	✓	
C	x	✓	✓	x	
D	x	✓	x	x	

3. Which features are correct for a competitive inhibitor of an enzyme-catalyzed reaction? (Y = correct, N = incorrect)

	Binds to active site	Changes shape of enzyme	Similar shape to substrate	Rate of reaction affected by concentration of inhibitor
A)	Y	N	Y	Y
B)	Y	N	N	Y
C)	N	Y	Y	N

	Binds to active site	Changes shape of enzyme	Similar shape to substrate	Rate of reaction affected by concentration of inhibitor
D)	N	Y	N	N

Correct answer: A

Explained solution: The features of a competitive inhibitor are that it has a similar shape to the substrate which enables it to bind to the active site of the enzyme. It does not affect the enzyme shape it binds to the active shape and not the allosteric site. The rate of reaction is affected by the concentration of inhibitor because when there is a higher concentration of competitive inhibitor, the frequency of ESC formation between the inhibitor and the active site increases.

Enzymes Topical Theory Questions

How does enzyme lower E_a ?

1. Provides alternative energy pathway
2. Brings reactants close together to form ESC
3. Puts strain on reactant
4. So bonds break easily
5. Transfer of charges between groups

Candidates are asked to describe and explain enzyme graphs of rate against substrate concentration. Here are a few key points you need: (D = description, E = explain, ROR = rate of reaction)

1. D - at low substrate conc, ROR proportional to substrate conc.
2. E - not all active site occupied
3. E - so substrate concentration is limiting
4. E - so fewer ESC formed
5. D - at high concentration less steep increase in rate of reaction
6. D - it levels out/plateaus at (XYZ) concentration
7. E - enzyme concentration is limiting
8. E - since all active sites are occupied/saturated
9. E - V_{max} reached

Outline experiment that should be carried out to find out if inhibitor is competitive or non-competitive

1. Carry out experiment with and without an inhibitor
2. At many different concentrations of substrates
3. Keeping other variables constant (eg pH and temp)
4. Draw a graph of rate of reaction against substrate concentration
5. If inhibitor is competitive then V_{max} is same as without inhibitor

Explain what is meant by higher K_m

1. Enzyme has lower affinity for substrate
2. Needs a higher concentration of substrate to reach V_{max}
3. Less likely to be saturated by substrate

4. Cell Membranes and Transport Topical MCQs

1. Which functions are correct for components of the cell surface membrane?

	Stabilising the hydrophobic layer	Barrier to dissolved ions	Allowing osmosis to occur
A)	Cholesterol	Phospholipids	Phospholipids and proteins
B)	Glycolipids	Proteins	Phospholipids
C)	Phospholipids	Cholesterol	Proteins
D)	Proteins	Glycolipids	Glycoproteins and glycolipids

Correct answer: A

Explained solution: The cholesterol maintains the fluidity of the membrane and hence acts as a stabiliser so column one in A is correct. The phospholipids are hydrophobic so they do not allow hydrophilic, charged, polar molecules and ions to pass through and act as a barrier hence the second condition is met. Osmosis requires water molecules to pass through the membrane and they may use transport proteins. Both phospholipids and proteins allow osmosis to occur hence column three is correct.

2. Which statement describes endocytosis?

- A) movement across a membrane against the concentration gradient and requiring energy
- B) movement across a membrane down the concentration gradient using a carrier molecule
- C) movement across a membrane into a cell using a vesicle requiring energy
- D) movement across a membrane using a vesicle and requiring no energy

Correct answer: C

Explained solution: endocytosis is an active process and requires energy so option D is eliminated. Option A describes active transport and not endocytosis so we can eliminate that. Endocytosis does not require a carrier molecule; statement B describes facilitated diffusion. Hence C is the correct answer.

3. Which substances can pass directly through cell surface membranes **without** using a carrier protein or

channel protein?

- 1 - CO₂
- 2 - Ca²⁺ and Na⁺
- 3 - H₂O

- A) 1 and 2
- B) 1 and 3
- C) 2 and 3
- D) 2 only

Correct answer: B

Explained solution: Molecules which **require** transport proteins need to be transported by active transport or facilitated diffusion - these molecules are generally too large or polar. We can eliminate number 2 because it would require the use of transport proteins as it is charged. The only option remaining is B.

Cell Membranes and Transport Theory Questions

Candidates are often asked "how is XYZ a cell signalling mechanism". These are the general points to write when approaching the question

1. The "molecule" [given in qs] acts as a cell signalling molecule
2. It moves through the bloodstream/extracellular space /intracellular space
3. To reach the **target cell** which is the [given in qs]
4. It will bind to **complementary, specific**, receptors [on the cell membrane - depends on qs]
5. This will lead to response which is [given in qs]
6. AVP e.g. detail of change, such as activating G proteins / secondary messenger / enzyme cascade /chain of reactions

How does phospholipid molecule make it suitable for its function.

1. Hydrophilic phosphate head and hydrophobic fatty acid tail
2. Forms a bilayer with head outside and tail inside
3. Head faces aqueous environment and tail faces each other to form hydrophobic core
4. Forms H-bonds with water
5. Stabilises membrane
6. Fatty acid may be saturated/unsaturated
7. Unsaturated makes membrane fluid
8. Barrier to polar substance

Why is it called the fluid mosaic model?

1. phospholipid (and protein) molecules, move about/diffuse/AW ;
2. protein (molecules), scattered/AW ; A different proteins present

5. The Mitotic Cell Cycle Topical MCQs

1. Immediately after which stage in mitosis in an animal cell does the cytoplasm start to divide?

- A) anaphase
- B) metaphase
- C) prophase
- D) telophase

—

Correct answer: D

Explained solution: the division of cytoplasm begins during cytokinesis which occurs after the last stage of mitosis which is telophase hence D.

2. Which row shows two pairs of nucleotide bases in a molecule of DNA

	First base pair	First base pair	Second base pair	Second base pair
	Bases present	Num of H-bonds	Bases present	Num of H-bonds
A)	AT	2	CG	2
B)	AT	2	CG	3
C)	TA	3	GC	2
D)	TA	3	GC	3

—

Correct answer: B

Explained solution: the order of the bases does not matter for eg. if the base is written as AT or TA - this has been put to confuse you. There are 2 H bonds between AT and 3 H bonds between CG hence B is the correct solution.

3. Cancer cells divide out of control, forming tumours. Which statement describes the difference between a cancer cell and a normal cell?

- A) Cancer cells do not undergo cytokinesis
- B) Cancer cells have a shorter interphase
- C) Cancer cells do not have metaphase
- D) Only cancer cells have mutated DNA

—

Correct answer: B

Explained solution: Cancer cells divide rapidly and to do this they must have a shorter cell cycle than a normal cell and so they have a shorter interphase. Hence the answer is B.

The Mitotic Cell Cycle Topical Theory Questions

Outline role of microtubules in mitosis

1. Forms part of spindle fibre
2. Attaches to centromere/chromosome
3. Moves sister chromatids to opposite poles

Suggest importance of mitotic cell cycle timing and control:

1. Coordination of growth
2. Minimises exposure to mutation
3. Prevents tumour formation
4. Which would spread to other tissues
5. Allows producing cell only when required

State two differences between the chromosome at metaphase and the chromosome at late anaphase

1. two chromatids versus, one chromatid / one daughter chromosome ;
2. sister chromatids joined at centromere versus chromatids separated
3. distance between sister chromatids zero versus increasing distance between chromatids
4. share a centromere versus do not share a centromere / centromere divides
5. two DNA molecules versus one DNA molecule ;
6. at, equator / metaphase plate versus towards / at, poles ; R centre R ends
7. linear / straight versus V shape / AW

Outline function of telomeres (Note: This question is seen very frequently in past year papers)

1. permit continued replication ;
2. prevent loss of genes ; I prevents gene damage A genetic / coded, information A protein coding regions of DNA
3. protect ends of chromosomes from being, degraded / AW ;
4. AVP ; e.g. prevents ends of chromosomes from being attached to each other not mistaken for a break in DNA that needs repairing

6. Nucleic Acids and Protein Synthesis Topical MCQs

1. DNA polymerase catalyses condensation reactions between molecules during semi-conservative replication of DNA. Which two molecules are joined by DNA polymerase?

- A) base and base
B) base and nucleotide
C) nucleotide and nucleotide
D) phosphate and deoxyribose

—
Correct answer: C

Explained solution: DNA polymerase catalyses the formation of phosphodiester backbone by joining nucleotides together so the phosphate on the first nucleotide can form phosphodiester bonds with the ribose sugar on the second nucleotide.

A length of double-stranded DNA contains 120 nucleotides and codes for a section of a polypeptide.

What is the maximum length of this section of a polypeptide?

- A 20 amino acids
B 40 amino acids
C 60 amino acids
D 120 amino acids

2. A length of double-stranded DNA contains 120 nucleotides and codes for a section of a polypeptide. What is the maximum length of this section of a polypeptide?

- A) 20 amino acids
B) 40 amino acids
C) 60 amino acids
D) 120 amino acids

—
Correct answer: A

Explained solution: We can do $120/2 = 60$ nucleotides on 1 strand. Each codon (triplet code) codes for 1 amino acid so we do $60/3 = 20$ amino acid. We take 1 strand because during protein synthesis only 1 strand of the DNA is transcribed to mRNA and the single strand is translated.

3. What is the maximum number of codon-anticodon interacts within one ribosome?

- A) 2
B) 3
C) 4
D) 6

—
Correct answer: A

Explained solution: when mRNA binds to the ribosome, 2 codons (or $2 \times 3 = 6$ bases) are on the ribosome unit at a time so the max number of tRNA anticodons binding to the mRNA codons is 2.

Nucleic Acids and Protein Synthesis Theory Questions

Explain how the structure of DNA enables it to replicate semi-conservatively.

1. base pairing/A-T and C-G; A purine - pyrimidine
2. ref to complementary/explained with ref to H bonds; R complementary in wrong context
3. (free) nucleotides pair with both, strands/each strand/polynucleotides/sides;
4. both strands act as templates;

5. to produce two DNA molecules that are identical to one another;

State what is meant by a STOP codon:

1. Codon that terminates polypeptide synthesis / translation / transcription
2. Does not code for an amino acid
3. Has no complementary anticodon
4. Causes release of polypeptide chain

Role of mRNA after leaving nucleus:

1. translation /use of, nucleotide / base, sequence, to make, amino acid chain / polypeptide / protein
2. moves towards / combines with, ribosome ;
5. transfer / t, RNA, bringing, amino acid(s), to mRNA / ribosome ;
6. The tRNA anticodon(s) bind with the codons on the mRNA ; only accept in correct context
7. (complementary) base pairing ;
8. any e.g. of codon:anticodon base pairing ; need six bases
9. ref to polyribosome(s) / used by many ribosomes ;
10. (mRNA short-lived) ref to production of protein for short period of time ;

7. Transport in Plants Topical MCQs

1. What could increase the rate of transpiration?

- A) increasing the humidity
- B) increasing the light intensity
- C) decreasing the temperature
- D) decreasing the wind speed

Correct answer: B

Explained solution: increasing the light intensity will increase the rate of evaporation of water in the leaf hence there will be a high concentration of water vapor in the leaf. Water vapour diffuses out of the leaf from a high concentration to low concentration down the gradient faster.

2. Which two rows are correct for movement of water from soil into a root?

	Soil	Root
1	Lower solute concentration	Higher solute concentration
2	High water potential	Low water potential
3	High solute concentration	Low solute concentration
4	Low water potential	High water potential

- A) 1 and 2
- B) 1 and 4
- C) 2 and 3
- D) 3 and 4

Correct answer: A

Explained solution: Water travels by osmosis from high water potential to low water potential down a partially permeable membrane (in this case the cell membrane of root) hence option 2 is correct. A low solute concentration indicates a higher water concentration to dissolve the solutes. A high solute concentration indicates a lower water concentration so less water dissolves solutes. In reference to option 1, the soil has more water and the root has less water so by osmosis water moves into the root. Hence, the correct answer is A.

3. ATP is used in companion cells to provide the energy for loading a sieve tube element with sucrose. How does the co-transporter mechanism use this energy?

- A) to pump hydrogen ions into the sieve tube element
- B) to pump hydrogen ions out of the companion cell
- C) to pump sucrose into the sieve tube elements
- D) to pump sucrose out of the companion cell

Correct answer: B

Explained solution: during loading, active transport is used to pump H⁺ ions into out of the companion cell and into the membrane so there is a high concentration of H⁺ in the membrane. H⁺ ions diffuse back into the companion cell with the cotransport of sucrose. Here, ATP is only used in the active transport of H⁺ out of the companion cell hence, B is correct.

Transport in Plants Topical Theory Questions

Describe the role of companion cells in translocation in the phloem.

1. sucrose/sugars/assimilates, are pumped/loaded (by companion cells);
2. reference to pumping H⁺;
3. reference to co-transport/AW e.g. H⁺ carry sucrose with them;
4. mitochondria provide, ATP for active transport;

Describe how the assimilate is moved from source to sink.

1. H⁺ / protons, (move) out of companion cells by, active transport
2. H⁺ / protons, diffuse (back) in with / cotransport sucrose, into companion cells (ref. to companion cell required only once for mps 1 and 2)
3. via, cotransporter / cotransporter described ;
4. sucrose, diffuses / AW, into (phloem) sieve, tube / element, via plasmodesmata ;
5. (entry of sucrose into sieve tube so) water potential lowers ;
6. water enters by osmosis ;

- (hydrostatic) pressure builds up ; A pressure difference created
- unloading at, sink / named sink, gives a difference in pressure (between source and sink) ; AW
- (so) mass flow of assimilates/water/sap occurs

Function of water stored in the vacuoles of plant cells:

- (raw material) for photosynthesis; A for photolysis
- maintains turgidity / provides support;
- pushes chloroplasts to edge of cell;
- used in hydrolysis reactions;
- solvent for, ions / named ion / pigment / named pigment;

8. Transport in Mammals

Topical MCQs

1. Which components of blood are present in tissue fluid?

	Phagocytes	Proteins	Sodium ions
A)	Present	Present	Present
B)	Present	Not Present	Not Present
C)	Not Present	Present	Present
D)	Not Present	Present	Not Present

Correct answer: A

Explained solution: Due to the hydrostatic pressure, molecules in the blood plasma move out of the gaps in capillaries and into the tissue fluid. Phagocytes are present in tissue fluid to move to areas where they are needed for immune response. A water potential between the capillary and tissue fluid cause water to enter the tissue fluid by osmosis, small proteins and molecules such as sodium ions also exit.

2. In mammals, some CO₂ is transported by red blood cells in combination with haemoglobin. What is the product of this combination?

- carbaminohemoglobin
- carbonic acid
- carboxyhemoglobin
- haemoglobinic acid

Correct answer: A

Explained solution: Carbonic acid is formed by the combination of CO₂ and water. Carboxyhemoglobin is the combination of haemoglobin and carbon monoxide. Haemoglobinic acid is formed by the combination of haemoglobin and hydrogen.

What effect does decreasing carbon dioxide concentration have on haemoglobin?

- It is less efficient at taking up oxygen and less efficient at releasing oxygen.
- It is less efficient at taking up oxygen and more efficient at releasing oxygen.
- It is more efficient at taking up oxygen and less efficient at releasing oxygen.
- It is more efficient at taking up oxygen and more efficient at releasing oxygen.

3. What effect does decreasing carbon dioxide concentration have on haemoglobin?

- It is less efficient at taking up oxygen and less efficient at releasing oxygen
- It is less efficient at taking up oxygen and more efficient at releasing oxygen
- It is more efficient at taking up oxygen and less efficient at releasing oxygen
- It is more efficient at taking up oxygen and more efficient at releasing oxygen

Correct answer: C

Explained solution: As CO₂ concentration decreases, less H⁺ ions are released into the blood. Hb has a greater affinity for H⁺ ions and so if the concentration of H⁺ decreases, Hb will start to combine with oxygen more. When H⁺ concentration is high, oxygen is removed from Hb and H⁺ combines with Hb instead and removes the oxygen so when the H⁺ conc is low, less oxygen is released. Hence it is more efficient at taking up oxygen and less efficient at releasing oxygen.

Transport in Mammals

Topical Theory Questions

Explain, with reference to function, the difference in the thickness of muscle of the left and right ventricle.

- The left ventricle pumps blood to rest of the body **and** the right ventricle pumps blood to the lungs
- Right ventricle has smaller muscles because travel is short distance
- Less **resistance**
- Less force/pressure required

Explain how the structure of red blood cells is suited to their function of transporting oxygen to body tissues.

- small size / 6-8 μm (diameter), to squeeze through capillaries (7 μm)
- small size / 6-8 μm (diameter), so, haemoglobin (molecules) near to surface (of plasma membrane) / reduces distance for diffusion (in / out of rbc)
- no nucleus / lack of organelles, so more room for haemoglobin (so more oxygen transported) ; R more room for oxygen
- biconcave shape / diagram drawn, increases surface area for, diffusion / uptake / release (of oxygen)
- flexible / AW (membrane), to squeeze through capillaries

Explain how heart action is initiated and controlled (reference should be made to the sinoatrial node, the

atrioventricular node and the Purkyne tissue).

1. The heart is myogenic;
2. SAN is the pacemaker /sends out impulses / waves of excitation / initiates contraction
3. AVN delays, impulse / contraction (of ventricles);
4. Relays impulse to Purkyne tissue / bundle of His;
5. Purkyne tissue conducts (impulse) to base / apex of heart / septum/ ventricles;
6. Ventricle (muscle) contracts / ventricular, contraction / systole, from base upwards;
7. Blood is pumped into arteries

9. Gas Exchange Topical MCQs

1. Which structures are found in the bronchi?

- A) cartilage and smooth muscle
- B) smooth muscle, cartilage and goblet cells
- C) smooth muscle and goblet cells
- D) cartilage and goblet cells

Correct answer: B

Explained solution: This question is based on information recall. The bronchi contains an open U-shaped cartilage. It contains smooth muscle to control the diameter of the airway. It contains goblet cells to traps dust, other particles and move it away from the lungs.

2. Which tissue in the respiratory system is correctly linked to its function?

	Tissue	Function
A)	Cartilage	stretch and recoil to force air out
B)	Ciliated epithelium	gives protection from suspended particles in the air
C)	Elastic fibres	contract and relax to adjust diameter of bronchioles
D)	Smooth muscle	keeps trachea and bronchi open

Correct answer: B

Explained solution:

Tissue	Function
Cartilage	keeps trachea and bronchi open
Ciliated epithelium (correct)	gives protection from suspended particles in the air
Elastic fibers	stretch and recoil to force air out
Smooth muscle	contract and relax to adjust diameter of bronchioles

3. Which statements about the human gas exchange system are correct?

	Statement
1)	the absence of cartilage in small bronchioles allows them to expand.
2)	the walls of the alveoli are made of cuboidal epithelium
3)	alveoli secrete surfactant which reduces surface tension in the lungs.
4)	the trachea and bronchi are supported by circles of cartilage

- A) 1 and 2
- B) 1 and 3
- C) 2 and 4
- D) 3 and 4

Correct answer: B

Explained solution: Statement 2 is incorrect because the walls of the alveoli are made of simple squamous epithelium which are thin flat cells. Statement 4 is incorrect because the bronchi is made of C shaped cartilage not circles.

Gas Exchange Topical Theory Questions

Role of mucus in the gas exchange system:

1. Lines surface (of epithelium);
2. Sticky;
3. Traps, dust/spores/bacteria/AW;
4. Moved by cilia;
5. Towards throat/away from lungs;
6. Protects, alveoli/gas exchange surface.

Describe process of gas exchange between alveoli and blood

1. Carbon dioxide diffuses out of blood and oxygen diffuses into blood
2. By diffusion; From an area of high concentration to an area of low concentration down the gradient
3. Across the squamous epithelium cells of alveoli
4. And endothelial cells of capillary walls A squamous cells but must be made clear this is for capillaries
5. Oxygen binds to RBCs | oxygen binds to Hb
6. Steep concentration gradient maintained by good air ventilation/uptake by haemoglobin/blood carries oxygen away / blood arrives with carbon dioxide / deoxygenated blood arriving low in oxygen

Smooth muscle in the trachea and in the bronchi relaxes during strenuous exercise. Suggest the advantages of relaxing this smooth muscle during periods of strenuous exercise

1. more air / oxygen, reaches the, alveoli or gas exchange surface ;

- more gas exchange or greater absorption of oxygen or excretes more carbon

dioxide

- satisfies increased demand for oxygen
- trachea and bronchi widen (*other words such as dilate, expand, enlarge may also be used in place of widen*)
- reduces resistance to air flow

10. Infectious Diseases

Topical MCQs

1. Which disease is caused by a eukaryote?

- A) cholera
- B) malaria
- C) tuberculosis
- D) HIV/AIDS

Correct answer: B

Explained solutions: Malaria is caused by *Plasmodium falciparum*, *Plasmodium ovale*, *Plasmodium vivax*, *Plasmodium malariae* which are all eukaryotes.

2. What do pathogens of TB, Malaria, and HIV/AIDS have in common?

	Cell surface membrane	Genes	Ribosome
A)	Common	Common	Common
B)	Common	Not Common	Not Common
C)	Not Common	Common	Common
D)	Not Common	Common	Not Common

Correct answer: D

Explained solution: HIV/AIDS is a virus so does not have ribosomes and has a viral envelope made of lipid instead of a cell surface membrane. It has naked RNA genes. Malaria is a eukaryote so it has cell surface membrane, genes in nucleus and ribosomes. Malaria is a bacteria so it has a cell surface membrane, circular DNA genes and 70S ribosomes. These 3 diseases only have genes in common hence the answer is D.

3. How does penicillin affect bacteria?

- A) It inhibits DNA replication by binding to nucleotides
- B) It inhibits translation by preventing tRNA binding to ribosomes
- C) It is a competitive inhibitor of an enzyme in cell wall synthesis
- D) It is a competitive inhibitor of an enzyme in protein synthesis

Correct answer: C

Explained solution: Penicillin acts by inhibiting transpeptidase enzyme which catalyzes the formation of cell wall. When a bacteria grows, autolysin makes holes in the cell walls. The

holes allow the wall to stretch and link peptidoglycan chains. Penicillin does not allow the linking to occur so the autolysin continues to make holes which weakens the cell wall until the bacteria bursts due to osmotic pressure.

Infectious Diseases Topical Theory Questions

Explain what is meant by disease

- ill-health / absence of well-being / abnormal condition
- reduced effectiveness of, functions
- (illness with a set of) symptoms or signs
- poor mental or social, well-being ;

Reason for increase in the cases of TB in developed countries now:

- development of antibiotic resistance (by organism)
- TB acts as an opportunistic infection and may be activated when the immune system is suppressed due to an HIV infection
- higher rate of immigration from countries with high incidence
- increase in tourism to countries with high incidence ;
- reduced surveillance leading to undetected cases (and hence spread) ;
- unwillingness to maintain drug routine
- vaccination programmes no longer taking place, it is difficult to reach people in remote areas
- Diagnosis is difficult because it remains dormant
- Limited education about prevention for general population

Explain why cholera remains a significant infectious disease in some parts of the world.

- poor sanitation or no treatment of faecal waste;
- contamination of (drinking) water supply;
- poor living conditions / poor hygiene / poor (health) education;
- natural disasters cause a rise in cholera because medical help or treatment cannot arrive in time
- no rehydration therapy available when needed
- no (effective) vaccine

Explain why vaccination programs have not be able to eradicate malaria

- several, different, causative species with different antigens
- as the pathogen is eukaryotic is has several different antigens many more than a prokaryote
- mutations may change the antigens of the pathogen
- pathogen has different stages of life cycle with different antigens ;

5. antigenic concealment / pathogen spends part of life cycle within host cells
6. more than one type of vaccine needed to target the different antigens in different species and parts of life cycle
7. lack of trained people to give vaccines
8. poor nutrition and poor immune response to vaccines

11. Immunity Topical MCQs

1. Which statement describes how passive natural immunity is obtained?

- A) A vaccination containing a dead organism is given
- B) An immunisation containing specific antigens is given
- C) Antibodies are passed from mother to child
- D) Antibodies from another individual are injected

—
Correct answer: C

Explained solution: passive natural immunity is a short term immunity obtained by a child or fetus through the mother hence C is correct.

2. Hybridomas are used as a basis for the production of large numbers of monoclonal antibodies. Which statement describes how hybridomas are made?

- A) fusing activated T-lymphocytes with cancer cells
- B) fusing B-lymphocytes with cancer cells
- C) fusing memory cells with cancer cells
- D) fusing T-lymphocytes with cancer cells

—
Correct answer: B

Explained solution: B-lymphocytes are chosen because they can differentiate into plasma cells which can produce antibodies. Cancer cells are chosen because they can divide rapidly. Hence for monoclonal antibodies, B-cells are fused with cancer cells so B is correct.

3. What is the first response by the immune system to a pathogen?

- A) ingestion of the pathogen by phagocytosis
- B) production of antibodies
- C) production of antigens
- D) stimulation of B memory cells

—
Correct answer: A

Explained solution: When a pathogen enters the body, their antigens are recognized as non-self. Phagocytes are attracted

to the site of the pathogen as a first response and engulf them by phagocytosis as a first response.

Immunity Topical Theory Questions

Outline how a vaccine can protect against xyz disease

1. Vaccine contains antigens
2. Primary immune response occurs
3. B-lymphocytes undergo clonal selection. Only specific B cells with receptors complementary to antigen will be activated
4. These cells divide by mitosis (clonal expansion) to develop into plasma cells
5. which secrete antibodies
6. Production of memory cells
7. T-helper cells secrete cytokines
8. Cytokines stimulate specific B-cells/ macrophages/ killer T-cells / increases humoral response
9. Secondary immune response is much faster
10. Higher level antibodies are produced during reinfection
11. This gives artificial active immunity

What is meant by the specificity of antibody:

1. variable region different for each antibody
2. binding region to antigen;
3. shape is specific and complementary to antigen ;
4. R groups on amino acids interact with other R groups in the polypeptide and the antibody
5. different, sequences of amino acids / primary structures is different for each antibody and gives specificity ;

What is the role of memory cells

1. Remain in circulation/lymphatic system
2. For **secondary** response
3. Faster response when exposed to the same pathogen again A faster clonal selection/clonal expansion or divide quickly/rapidly or longer lasting response
4. To form plasma cells
5. More antibodies produced
6. To prevent symptoms

CAIE AS LEVEL Biology (9700)

Copyright 2022 by ZNotes

These notes have been created by Saivi Dhanesh Zaveri for the 2022 syllabus

This website and its content is copyright of ZNotes Foundation - © ZNotes Foundation 2022. All rights reserved.

The document contains images and excerpts of text from educational resources available on the internet and printed books. If you are the owner of such media, text or visual, utilized in this document and do not accept its usage then we urge you to contact us and we would immediately replace said media.

No part of this document may be copied or re-uploaded to another website without the express, written permission of the copyright owner. Under no conditions may this document be distributed under the name of false author(s) or sold for financial gain; the document is solely meant for educational purposes and it is to remain a property available to all at no cost. It is current freely available from the website www.znotes.org

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.