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VCE Biology ¾

Lymphatics & Adaptive Immunity (Humoral) [3.3]

Homework

Admin Info & Homework Outline:

Student Name	
Questions You Need Help For	
Definitions	Pg 2 - Pg 13
Multiple Choice Questions	Pg 14 - Pg 35
Content Recall Questions	Pg 36 - Pg 53

Section A: Definitions

Definitions

- Naïve

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- Immunological memory

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- Lymph

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- Lymphatic system

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- Secondary lymphoid tissue

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- Primary lymphoid tissue

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- Antigen-presenting cell

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- Lymph node

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- Clonal selection theory

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- Clonal expansion

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- Differentiation

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- Antibody

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- Agglutination

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Key Takeaways

- ☑ You need to UNDERSTAND the process of adaptive immunity, so that when you recall the steps you don't get confused over minor details (which aren't even tested outside of SACs mostly).
- ☑ A lot of the questions will be more APPLICATION and DATA based, so simply memorising the pathways and the effects WONT be enough.
- ☑ Pay close detail to the workshop questions!

Space for Personal Notes

Sub-Section [3.3.1]: Identify the Structure of the Lymphatic System, Including Primary & Secondary Lymphatic Tissue

Question 1

Definitions:

a. Lymph

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b. Lymphatic vessels

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c. Primary lymphoid tissue

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d. Secondary lymphoid tissue

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e. Lymph nodes:

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Space for Personal Notes

Sub-Section [3.3.2]: Identify the Role of the Lymphatic System in Fighting Infections

Question 2

Definitions:

a. Immune surveillance

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b. Antigen-presenting cells (APCs)

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c. Lymph node function

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Space for Personal Notes

Sub-Section [3.3.3]: Explain Antigen Presentation as a Means to Initiate the Adaptive Immune Response

Question 3

Definitions:

a. Antigen

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b. Antigen presentation

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c. MHC-II (Major Histocompatibility Complex Class II)

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Space for Personal Notes

Sub-Section [3.3.4]: Identify the Characteristics of the Adaptive Response Which Differentiate it From the Innate Response

Question 4

Definitions:

a. Specificity

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b. Immunological memory

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c. Clonal expansion

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d. Delayed response

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Space for Personal Notes

Sub-Section [3.3.5]: Identify & Explain the Humoral Response as a Response to Extracellular Pathogens, Including the Role of B and T Helper Lympohocytes

Question 5

Definitions:

a. Humoral immunity

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b. Clonal selection

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c. Helper T cell (Th cell)

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d. Plasma cell

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e. Memory B cell

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Sub-Section [3.3.6]: Explain the Significance of Memory Cells to Generate Immunological Memory, & How that Prevents Future Infections

Question 6

Definitions:

a. Memory cell

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b. Secondary immune response

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c. Vaccination

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Space for Personal Notes

Sub-Section [3.3.7]: Differentiate Between Extracellular & Intracellular Threats

Question 7

Definitions:

a. Extracellular pathogen

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b. Intracellular pathogen

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c. Cell-mediated immunity

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Space for Personal Notes

Sub-Section [3.3.8]: Explain How Antibodies are Used to Fight Against Infections, and Draw their Structure

Question 8

Definitions:

a. Antibody (Immunoglobulin)

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b. Neutralisation

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c. Agglutination

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d. Opsonisation

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e. Complement activation

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f. Structure:

i. Variable region (arms)

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ii. Constant region (stem)

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Section B: Multiple Choice Questions (56 Marks)

Question 9 (1 mark)

After a Mars mission, astronauts encounter a pathogen similar to Earth's bacteria. During the body's response, a specific component of the immune system targets and neutralises these foreign pathogens. Which cells are directly responsible for producing the substances that identify and neutralise these pathogens?

A. T helper cells

B. Macrophages

C. B plasma cells

D. Natural killer cells

Question 10 (1 mark)

In developing a vaccine for a rapidly mutating virus threatening a distant space colony, scientists focus on stimulating a part of the immune system that can remember the virus and provide long-term protection. Which type of cell is the vaccine most likely trying to stimulate for enduring immunity?

A. Neutrophils

B. Memory B cells

C. Dendritic cells

D. Mast cells

Question 11 (1 mark)

A hiker returns from a trip and notices swollen lymph nodes. Considering the lymphatic system's role, what is the most likely process occurring in the hiker's lymph nodes in response to a potential pathogen encountered during the trip?

A. Accumulation of red blood cells.

B. Filtration of lymph and activation of the immune response.

C. Production of platelets.

D. Storage of excess lymph fluid.

Question 12 (1 mark)

A patient with chronic inflammation has elevated levels of antibodies. This suggests an overactive immune response, primarily involving which of the following processes?

A. Complement system activation.

B. Interferon release.

C. Humoral immunity.

D. Cell-mediated immunity.

Question 13 (1 mark)

In a simulated environment replicating Mars' conditions, a scientist tests a vaccine's effectiveness against hypothetical Martian pathogens. The vaccine needs to activate a specific immune response. Which cells should the vaccine target to ensure a robust humoral response?

A. Eosinophils

B. B lymphocytes

C. T cytotoxic cells

D. Monocytes

Question 14 (1 mark)

When the lymphatic system is overwhelmed by an infection, leading to a rapid immune response, what is the first observable symptom typically seen in patients?

A. Decreased heart rate.

B. Swelling of lymph nodes.

C. Reduced red blood cell count.

D. Increase in platelet aggregation.

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Question 15 (1 mark)

During a study on a new tropical disease, researchers discover that the pathogen can evade the humoral immune response, making it difficult to combat. What mechanism is the pathogen likely using to escape detection and neutralisation by the humoral immune system?

A. Suppressing complement activation.

B. Avoiding recognition by B cell receptors.

C. Inhibiting cytokine production.

D. Destroying T helper cells.

Question 16 (1 mark)

In the process of engineering a therapeutic antibody to neutralise a potent neurotoxin, what should be the primary focus to ensure the antibody effectively prevents the toxin from causing damage to the nervous system?

A. Inducing inflammation.

B. Promoting phagocytosis.

C. Neutralising the toxin.

D. Activating T helper cells.

Question 17 (1 mark)

In a laboratory experiment, scientists introduce a novel antigen into a mouse model to study the humoral immune response. The mouse has been genetically modified to lack B cells. What would be the expected outcome in terms of antibody production?

A. Increased antibody production due to compensatory immune mechanisms.

B. No change in antibody production.

C. Absence of specific antibody production.

D. Uncontrolled activation of the immune system.

Space for Personal Notes

Question 18 (1 mark)

A biotech company is developing a new class of drug that mimics the action of antibodies. They aim to target cancer cells without affecting healthy tissues. For this drug to be effective, what characteristic of antibodies should the drug primarily mimic?

A. Ability to induce inflammation.

B. Specificity to antigens.

C. Activation of complement system.

D. Binding to mast cells and basophils.

Question 19 (1 mark)

After a flood, a community experiences an outbreak of waterborne diseases. Public health officials are concerned about the spread of pathogens through the lymphatic system. Which part of the lymphatic system is primarily responsible for filtering pathogens from the lymph to prevent systemic infection?

A. Thymus

B. Spleen

C. Lymph nodes

D. Lymphatic vessels

Question 20 (1 mark)

A new therapeutic approach involves using monoclonal antibodies to block the entry of viruses into cells. This method is similar to which natural function of antibodies in the humoral immune response?

A. Phagocytosis enhancement.

B. Neutralisation of pathogens.

C. Activation of the complement system.

D. Induction of inflammatory responses.

Space for Personal Notes

Sub-Section [3.3.1]: Identify the Structure of the Lymphatic System, Including Primary & Secondary Lymphatic Tissue

Question 21 (1 mark)

What is the primary function of the bone marrow in the lymphatic system?

A. Filtering pathogens from the blood.

B. Producing and maturing B lymphocytes.

C. Storing immune cells.

D. Absorbing lipids from the digestive tract.

Question 22 (1 mark)

Which of the following best describes secondary lymphatic tissue?

A. It is the site of lymphocyte production and maturation.

B. It is the site where lymphocytes encounter antigens and initiate immune responses.

C. It produces red blood cells and platelets.

D. It transports oxygen throughout the body.

Question 23 (1 mark)

Lymph is transported through the body by:

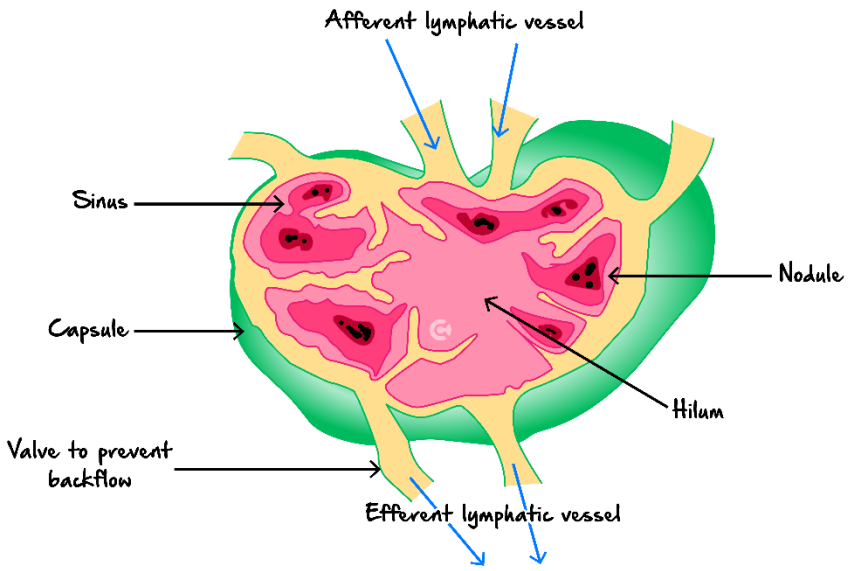
A. The heart actively pumping lymph through vessels.

B. Specialised lymphatic muscles contracting.

C. Skeletal muscle movement and valves preventing backflow.

D. Direct diffusion through tissues.

Question 24 (1 mark)



Source : SEER Training Modules, Cancer Registration & Surveillance Modules, U.S. National Institutes of Health, National Cancer Institute. Accessed 4 January 2018. https://training.seer.cancer.gov/

When lymph fluid enters a lymph node through the afferent vessel and passes through the sub-capsular area, which contains macrophages and dendritic cells, what is the primary significance of these cells being located in this region?

A. They primarily produce lymphocytes to boost the immune cell count.

B. They generate antibodies that circulate in the lymph fluid.

C. They capture, process, and present antigens to T cells, thereby initiating the adaptive immune response.

D. They secrete digestive enzymes to break down all pathogens in the lymph.

Question 25 (1 mark)

Which of the following structures is NOT part of the secondary lymphatic system?

A. Spleen

B. Lymph nodes

C. Tonsils

D. Bone marrow

Sub-Section [3.3.2]: Identify the Role of the Lymphatic System in Fighting Infections

Question 26 (1 mark)

Which of the following best describes the role of lymph nodes in fighting infections?

A. They produce red blood cells for oxygen transport.

B. They filter lymph and trap pathogens for immune cell activation.

C. They store water for hydration.

D. They break down food in digestion.

Question 27 (1 mark)

Which type of white blood cell is most commonly found in lymph nodes to help fight infections?

A. Erythrocytes

B. Neutrophils

C. Lymphocytes

D. Platelets

Question 28 (1 mark)

How do lymphatic vessels help prevent the spread of infections?

A. By transporting pathogens directly to the bloodstream.

B. By filtering out harmful microorganisms before returning fluid to the circulatory system.

C. By storing all bacteria and viruses permanently.

D. By producing enzymes to digest pathogens.

Question 29 (1 mark)

How do lymphatic vessels contribute to immune surveillance?

A. By storing excess nutrients in tissues.

B. By transporting immune cells to sites of infection and inflammation.

C. By producing digestive enzymes.

D. By breaking down food molecules.

Question 30 (1 mark)

Which part of the lymphatic system is responsible for the maturation of T cells?

A. Spleen

B. Lymph nodes

C. Bone marrow

D. Thymus

Space for Personal Notes

Sub-Section [3.3.3]: Explain Antigen Presentation as a Means to Initiate the Adaptive Immune Response

Question 31 (1 mark)

Which cells are primarily responsible for antigen presentation in the initiation of the adaptive immune response?

A. Neutrophils

B. Eosinophils

C. Dendritic cells

D. Basophils

Question 32 (1 mark)

What is the function of major histocompatibility complex (MHC) molecules in antigen presentation?

A. They produce antibodies to neutralise pathogens.

B. They display antigen fragments to T cells for immune activation.

C. They engulf pathogens and destroy them immediately.

D. They stimulate the production of histamine to trigger inflammation.

Question 33 (1 mark)

Which type of major histocompatibility complex (MHC) molecule is responsible for presenting antigens to cytotoxic *T* cells?

A. MHC class I

B. MHC class II

C. MHC class III

D. MHC class IV

Question 34 (1 mark)

Helper *T* cells recognise antigens presented by which type of MHC molecule?

A. MHC class I

B. MHC class II

C. MHC class III

D. MHC class IV

Question 35 (1 mark)

Which of the following is NOT an antigen-presenting cell?

A. Macrophages

B. B cells

C. Neutrophils

D. Dendritic cells

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Sub-Section [3.3.4]: Identify the Characteristics of the Adaptive Response Which Differentiate it From the Innate Response

Question 36 (1 mark)

Which feature of the adaptive immune response allows it to specifically target pathogens?

A. The production of general inflammation.

B. The use of pattern recognition receptors.

C. The generation of antigen-specific receptors on B and T cells.

D. The rapid activation of complement proteins.

Question 37 (1 mark)

How does the adaptive immune response differ from the innate immune response in terms of response time?

A. The adaptive response is immediate, whereas the innate response is delayed.

B. The innate response is immediate, whereas the adaptive response takes longer to develop.

C. Both responses are equally fast.

D. The adaptive response is only activated if the innate response fails.

Question 38 (1 mark)

What is the role of memory cells in the adaptive immune response?

A. Memory cells recognise self-antigens to prevent autoimmunity.

B. Memory cells store information about past infections to enable a faster secondary response.

C. Memory cells stimulate inflammation to enhance innate immunity.

D. Memory cells act as antigen-presenting cells to activate naïve T cells.

Question 39 (1 mark)

Which statement best describes clonal selection in adaptive immunity?

A. Only innate immune cells divide upon detecting pathogens.

B. B and T cells with receptors matching a specific antigen proliferate upon activation.

C. All immune cells divide equally in response to infection.

D. Innate immune cells produce antigen-specific antibodies.

Question 40 (1 mark)

Which of the following is an example of an adaptive immune response?

A. A macrophage engulfing bacteria via phagocytosis.

B. The release of histamine by mast cells.

C. The production of antibodies against a viral infection.

D. The activation of complement proteins in response to bacteria.

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Sub-Section [3.3.5]: Identify & Explain the Humoral Response as a Response to Extracellular Pathogens, Including the Role of B and T Helper Lympohocytes

Question 41 (1 mark)

Which of the following cell types is directly responsible for antibody production in the adaptive immune response?

A. Macrophages

B. Cytotoxic T cells

C. B cells

D. Natural killer cells

Question 42 (1 mark)

Which of the following statements about antigen-presenting cells (APCs) is correct?

A. APCs directly kill infected cells.

B. APCs present antigens to T cells to initiate an adaptive immune response.

C. APCs are only found in the innate immune system.

D. APCs produce antibodies.

Question 43 (1 mark)

Which of the following immune cells is involved in both the innate and adaptive immune responses?

A. Neutrophils

B. Macrophages

C. Plasma cells

D. Memory T cells

Question 44 (1 mark)

Which cell type interacts with antigen-presenting cells to initiate the adaptive immune response?

A. B cells

B. Helper T cells

C. Cytotoxic T cells

D. Plasma cells

Space for Personal Notes

Sub-Section [3.3.6]: Explain the Significance of Memory Cells to Generate Immunological Memory, & How that Prevents Future Infections

Question 45 (1 mark)

What is the role of helper T cells in the humoral immune response?

A. Helper T cells directly kill infected cells.

B. Helper T cells activate B cells by releasing cytokines.

C. Helper T cells produce antibodies to neutralise pathogens.

D. Helper T cells act as antigen-presenting cells.

Question 46 (1 mark)

What triggers the activation of a specific B cell in the humoral response?

A. Direct recognition of a pathogen through phagocytosis.

B. Binding of a specific antigen to its B cell receptor and stimulation by a helper T cell.

C. Release of histamines from mast cells.

D. Interaction with cytotoxic T cells.

Question 47 (1 mark)

Which of the following best describes the role of antibodies in the humoral immune response?

A. Antibodies bind to pathogens to neutralise them and mark them for destruction.

B. Antibodies directly lyse infected cells through enzymatic activity.

C. Antibodies activate cytotoxic T cells to attack infected cells.

D. Antibodies stimulate the production of histamines for inflammation.

Question 48 (1 mark)

Which antibody function involves coating a pathogen to enhance phagocytosis by macrophages?

A. Neutralisation

B. Agglutination

C. Opsonisation

D. Complement activation

Question 49 (1 mark)

Which part of an antibody binds specifically to an antigen?

A. Constant region

B. Fc region

C. Heavy chain

D. Variable region

Space for Personal Notes

Sub-Section [3.3.7]: Differentiate Between Extracellular & Intracellular Threats

Question 50 (1 mark)

Which type of memory cell is responsible for the rapid production of antibodies upon secondary exposure to an antigen?

A. Memory T cells

B. Memory B cells

C. Cytotoxic T cells

D. Macrophages

Question 51 (1 mark)

Which of the following best describes the role of vaccination in generating immunological memory?

A. Vaccination stimulates the production of memory cells without causing disease.

B. Vaccination introduces active pathogens to train the immune system.

C. Vaccination suppresses the immune response to prevent unnecessary activation.

D. Vaccination directly attacks pathogens in the bloodstream.

Question 52 (1 mark)

Which statement best explains why some vaccines require booster doses?

A. Booster doses remove memory cells to prevent overactive immune responses.

B. Booster doses help reinforce the immune system by increasing the number of memory cells.

C. Booster doses prevent the body from producing excessive antibodies.

D. Booster doses activate the primary immune response again.

Question 53 (1 mark)

Which statement best explains the significance of clonal expansion in immunological memory?

A. Clonal expansion decreases the number of lymphocytes to prevent autoimmunity.

B. Clonal expansion is a process by which memory cells are generated to ensure a rapid response upon antigen re-encounter.

C. Clonal expansion occurs only during the innate immune response.

D. Clonal expansion prevents the differentiation of lymphocytes.

Question 54 (1 mark)

Which feature distinguishes memory T cells from naïve T cells?

A. Memory T cells are capable of immediate reactivation upon antigen re-exposure.

B. Memory T cells have a shorter lifespan than naïve T cells.

C. Memory T cells do not require antigen presentation for activation.

D. Memory T cells primarily reside in the bone marrow.

Space for Personal Notes

Sub-Section [3.3.8]: Explain How Antibodies are Used to Fight Against Infections, and Draw their Structure

Question 55 (1 mark)

Which of the following is an example of an extracellular pathogen?

A. Influenza virus.

B. *Mycobacterium tuberculosis.*

C. *Streptococcus pneumoniae.*

D. *Plasmodium falciparum.*

Question 56 (1 mark)

Which immune response is most effective against intracellular pathogens?

A. Complement system.

B. Phagocytosis by neutrophils.

C. Cytotoxic T cell-mediated killing.

D. Release of histamine by mast cells.

Question 57 (1 mark)

Which of the following components of the immune system is primarily responsible for targeting intracellular pathogens?

A. Plasma cells

B. Cytotoxic T lymphocytes

C. B lymphocytes

D. Neutrophils

Question 58 (1 mark)

How do intracellular pathogens evade immune detection?

A. By preventing phagocytosis.

B. By hiding inside host cells to avoid antibody recognition.

C. By blocking histamine release.

D. By activating the complement cascade.

Question 59 (1 mark)

Which of the following pathogens would most likely be eliminated by the humoral immune response?

A. Hepatitis B virus.

B. *Listeria monocytogenes*.

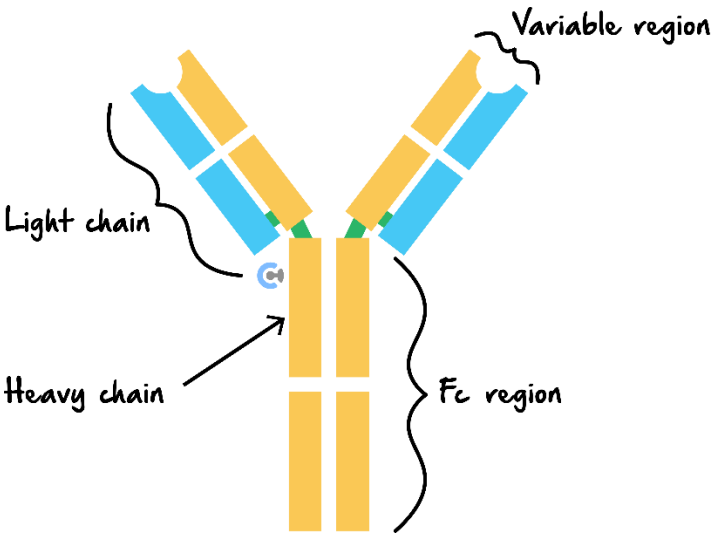
C. *Clostridium tetani*.

D. *Mycobacterium leprae*.

Space for Personal Notes

Sub-Section [3.3.9] :

Question 60 (1 mark)



What role does the Fc region of an antibody play?

A. It binds directly to antigens.

B. It interacts with immune cells and the complement system.

C. It determines the specificity of antigen recognition.

D. It forms a barrier against pathogen entry.

Question 61 (1 mark)

Which part of the antibody is responsible for antigen binding?

A. Constant region.

B. Light chain only.

C. Variable region.

D. Heavy chain only.

Question 62 (1 mark)

How do antibodies enhance phagocytosis?

A. By stimulating the complement system.

B. By marking pathogens for destruction through opsonisation.

C. By increasing the production of red blood cells.

D. By causing direct lysis of pathogens.

Question 63 (1 mark)

How does antibody-mediated agglutination help fight infections?

A. It kills pathogens directly.

B. It clumps pathogens together, making them easier to be phagocytosed.

C. It prevents pathogens from entering cells by degrading them.

D. It induces apoptosis in infected cells.

Question 64 (1 mark)

What is the significance of the disulphide bonds in antibody structure?

A. They bind directly to pathogens.

B. They allow antibodies to activate T cells.

C. They stabilise the overall structure of the antibody molecule.

D. They enable antigen-binding specificity.

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Section C: Content Recall Questions (67 Marks)

Sub-Section [3.3.1]: Identify the Structure of the Lymphatic System, Including Primary & Secondary Lymphatic Tissue

Question 65 (2 marks)

What distinguishes primary lymphatic tissue from secondary lymphatic tissue?

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Question 66 (2 marks)

How does the lymphatic system contribute to fluid balance in the body?

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Question 67 (2 marks)

What is the role of the thymus in T lymphocyte development?

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Question 68 (3 marks)

How does the lymphatic system contribute to overall immune function and pathogen defence?

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Space for Personal Notes

Sub-Section [3.3.2]: Identify the Role of the Lymphatic System in Fighting Infections

Question 69 (2 marks)

Why is the lymphatic system essential for long-term immunity?

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Question 70 (2 marks)

How do secondary lymphoid organs aid in the immune response?

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Space for Personal Notes

Question 71 (3 marks)

Describe the role of lymphocytes in the lymphatic system's immune function.

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Space for Personal Notes

Sub-Section [3.3.3]: Explain Antigen Presentation as a Means to Initiate the Adaptive Immune Response

Question 72 (2 marks)

Define antigen presentation in the immune response.

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Question 73 (2 marks)

Explain the role of dendritic cells in antigen presentation.

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Space for Personal Notes

Question 74 (2 marks)

How do macrophages function as antigen-presenting cells?

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Question 75 (3 marks)

Explain how antigen-presenting cells activate naïve T cells.

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Space for Personal Notes

Sub-Section [3.3.4]: Identify the Characteristics of the Adaptive Response Which Differentiates it From the Innate Response

Question 76 (2 marks)

Describe the process by which memory cells are generated in the adaptive immune response.

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Question 77 (2 marks)

What is the role of cytokines in the adaptive immune response?

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Space for Personal Notes

Question 78 (2 marks)

What does clonal expansion refer to in the adaptive immune response?

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Question 79 (3 marks)

Discuss the roles of T and B lymphocytes in the adaptive immune response and how they work together to eliminate pathogens.

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Space for Personal Notes

Sub-Section [3.3.5]: Identify & Explain the Humoral Response as a Response to Extracellular Pathogens, Including the Role of B and T Helper Lymphocytes

Question 80 (2 marks)

How do plasma cells contribute to immunity?

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Question 81 (2 marks)

Explain the role of dendritic cells in adaptive immunity.

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Space for Personal Notes

Question 82 (2 marks)

Explain the process of B cell activation and its role in adaptive immunity.

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Space for Personal Notes

Sub-Section [3.3.6]: Explain the Significance of Memory Cells to Generate Immunological Memory, & How that Prevents Future Infections

Question 83 (2 marks)

Describe the function of plasma cells in the humoral immune response.

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Question 84 (2 marks)

Describe the role of helper T cells in the activation of B cells.

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Space for Personal Notes

Question 85 (2 marks)

Explain the process of agglutination in the humoral response.

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Question 86 (3 marks)

Explain three different ways in which antibodies neutralise extracellular pathogens.

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Space for Personal Notes

Sub-Section [3.3.7]: Differentiate Between Extracellular & Intracellular Threats

Question 87 (2 marks)

Describe how the secondary immune response differs from the primary immune response due to immunological memory.

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Question 88 (2 marks)

Explain the process by which memory T cells are reactivated during a secondary immune response.

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Space for Personal Notes

Question 89 (2 marks)

How do memory B cells ensure a rapid antibody response during a secondary infection?

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Question 90 (3 marks)

.Discuss the significance of immunological memory in vaccine efficacy and long-term protection.

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Space for Personal Notes

Sub-Section [3.3.8]: Explain How Antibodies are Used to Fight Against Infections, and Draw their Structure

Question 91 (2 marks)

Describe how antibodies help eliminate extracellular pathogens.

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Question 92 (2 marks)

Explain why viruses are classified as intracellular pathogens.

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Space for Personal Notes

Question 93 (2 marks)

What role do cytotoxic T cells play in eliminating intracellular pathogens?

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Question 94 (3 marks)

.Describe how T helper cells contribute to both extracellular and intracellular pathogen defence.

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Space for Personal Notes

Sub-Section [3.3.9] :

Question 95

Describe the function of the variable region in an antibody.

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Question 96

How does affinity maturation improve the effectiveness of antibodies?

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Space for Personal Notes

Question 97

What is the significance of the constant region in an antibody molecule?

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Question 98

Explain how the structural features of antibodies contribute to the development of immunological memory and long-term immunity.

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