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Phone: +442081445350

www.chemistryonlinetuition.com

Email: asherrana@chemistryonlinetuition.com

BIOLOGY

CELLS

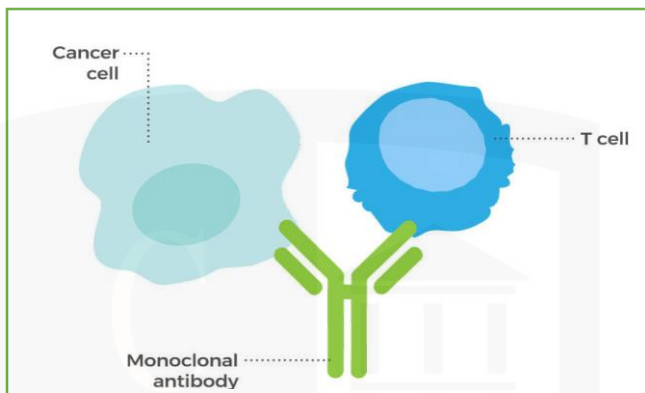
Level & Board	AQA (A-LEVEL)
TOPIC:	THE IMMUNE SYSTEM
PAPER TYPE:	QUESTION PAPER-2
TOTAL QUESTIONS	8
TOTAL MARKS	67

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The Immune System 2

1.

(a) Define monoclonal antibody? (1)



(b) Certain medical treatments involve the use of monoclonal antibodies once a disease has been identified.

Give an instance of a medical procedure that makes use of monoclonal antibodies. (1)

(c) Explain how antibodies contribute to an ELISA test result that is positive.

(4)

2.

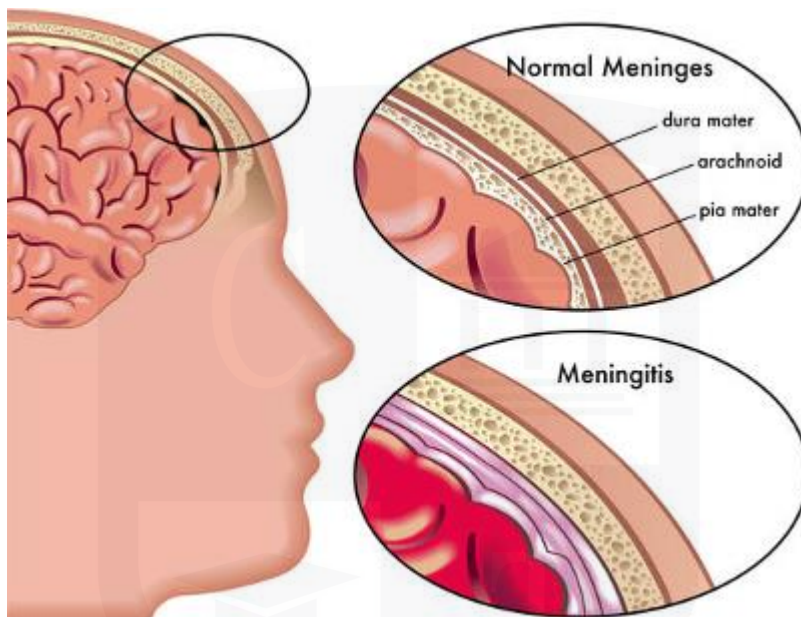
(a) Describe and clarify how antibodies contribute to the stimulation of phagocytosis.

Don't go into specifics about the phagocytosis process. **(2)**

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Meningitis is a disease caused by the meningococcus bacteria. By tracking changes in mice blood anti-meningitis antibody concentration, researchers looked into a new meningitis vaccine called MenG.



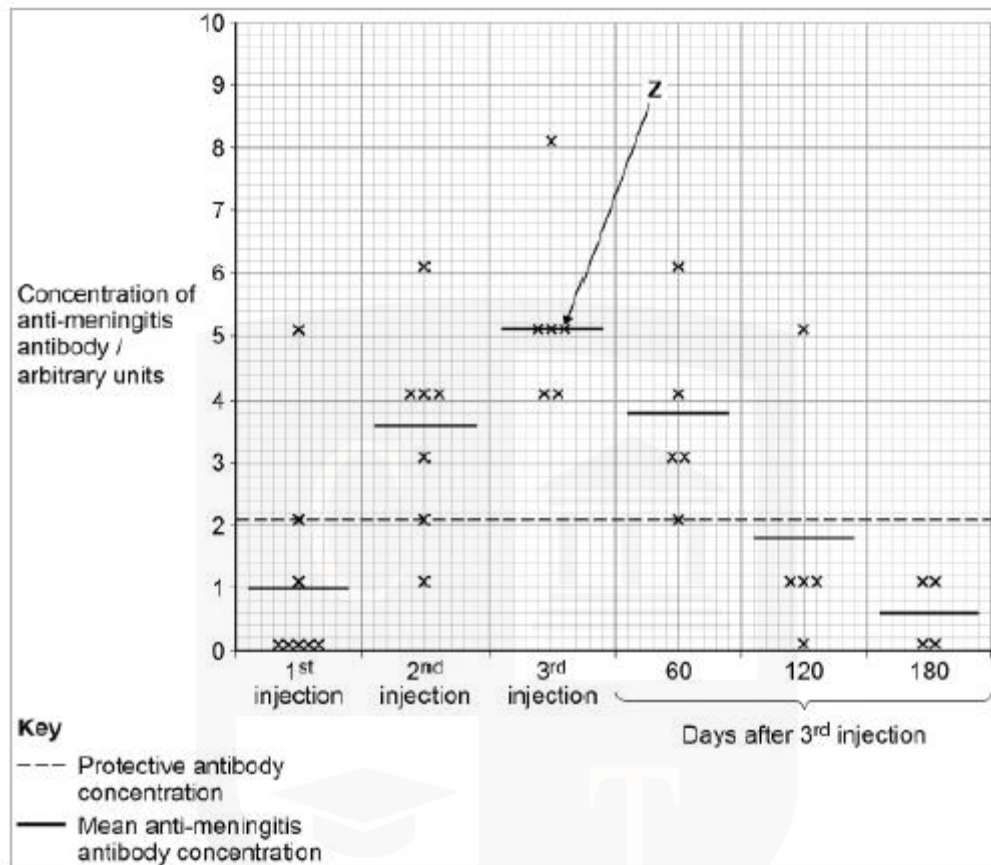
Three different MenG injections were administered to each mouse. Immediately following each injection, a blood sample was obtained to determine the anti-meningitis antibody concentration.

Following the third injection, blood samples were taken at 60, 120, and 180 days to determine the blood anti-meningitis antibody concentration.

The scientist findings are displayed on the graph. Every dot on the graph represents the outcome for a distinct mouse.

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(b) The researchers found that following the third injection, the anti-meningitis antibody concentration in the mouse designated Z in the above graph dropped steadily at a rate of 0.027 arbitrary units per day.

Determine how many days after the third injection the mouse antibody concentration is greater than its protective antibody concentration using the data and the graph. (2)

Answer = _____ days

(c) What conclusions can you draw about the impact of each injection on the mice immune response based on the above graph? (4)



(d) The researchers postulated that 180 days following the third injection, memory B cells had developed in the mice.

Provide a workable approach the scientists could take to test this theory, along with an explanation. **(2)**

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3.

(a) Venomous snakes inject a toxin into their victims when they bite them. As a treatment, antivenom is injected. Antibodies against the snake toxin are found in antivenom. Passive immunity is exemplified by this treatment.

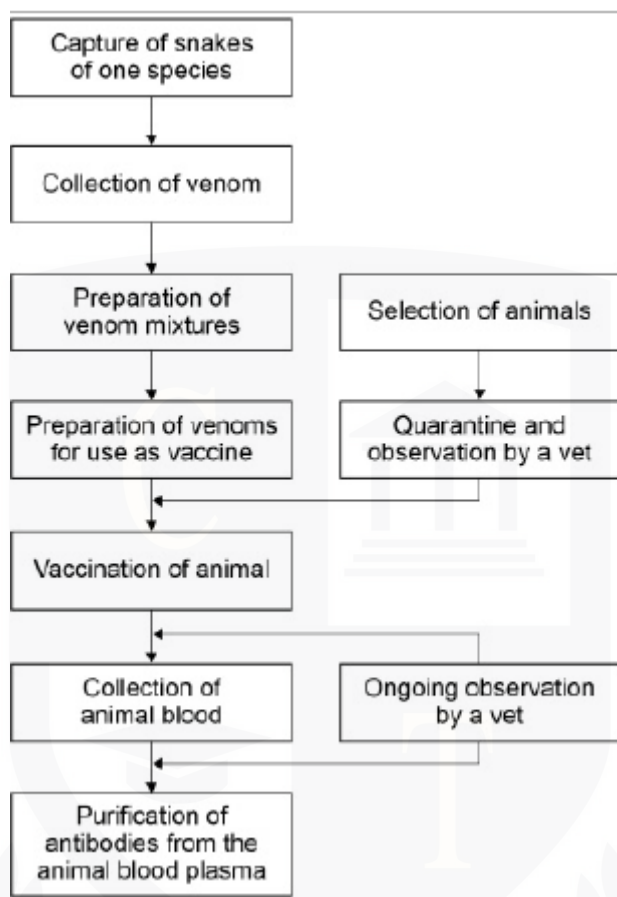


Describe the mechanisms of action of the antivenom treatment and the reasons behind the necessity of using passive immunity as opposed to active immunity. **(2)**

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The antivenom production process is depicted in the chart.



(b) A variety of venoms from various members of the same species are combined.

Explain why? **(2)**

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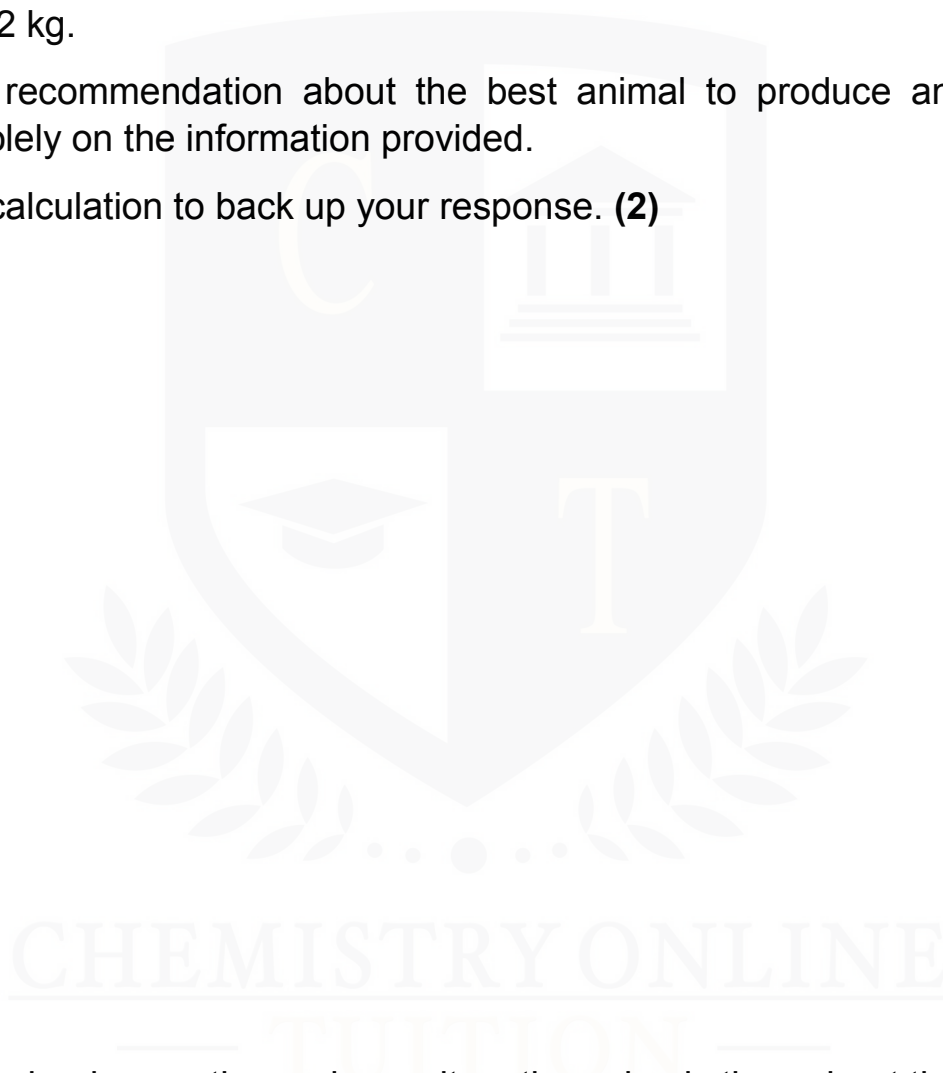
(c) Antivenoms can be made from rabbits or horses.

Thirteen centiliters of blood are drawn for every kilogram of the animal's body weight when extracting antibodies from blood.

Horses used had an average mass of 350 kg, while rabbits used an average mass of 2 kg.

Make a recommendation about the best animal to produce antivenoms based solely on the information provided.

Make a calculation to back up your response. **(2)**



(d) A veterinarian continuously monitors the animals throughout the process depicted in the chart.

Provide a single explanation. **(1)**

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(e) Each animal receives a tiny initial venom injection during vaccination. A bigger dose of venom is injected into it two weeks later.

Explain this vaccination program using what you know about the humoral immune response. **(3)**



4.

Read the following passage.

Azidothymidine (AZT) is a medication used to treat HIV infections in individuals. It prevents the enzyme from converting HIV RNA into DNA. This inhibits or delays the progression of AIDS but does not eradicate HIV from the body.

In the past, AIDS eventually struck some individuals who took AZT by itself. A portion of the HIV within them had developed resistance to AZT.

People infected with HIV are now treated with highly active antiretroviral therapy (HAART) to stop this from happening. This entails taking AZT concurrently with other anti-HIV medications.

One takes small doses of AZT. This is due to muscle atrophy experienced by those who took high doses for extended periods of time. It was discovered that AZT at high doses prevents mitochondria from replicating.

To answer the questions, draw on the information in the passage as well as your own expertise.

(a) Provide evidence and an explanation for why AZT inhibits or delays the progression of AIDS but does not eradicate HIV in the body (lines 3–4). **(4)**



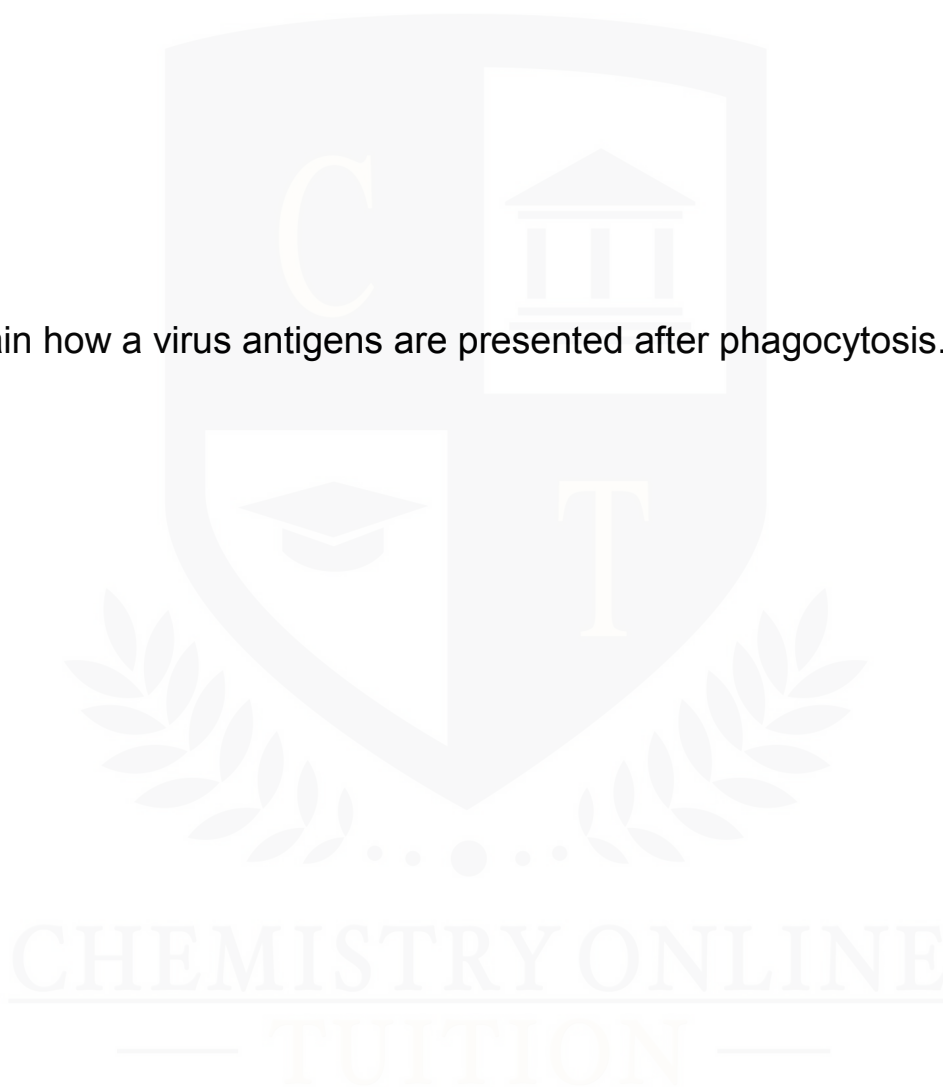
(b) List and describe two benefits of HAART (lines 7–9). **(4)**

Advantage 1

Advantage 2

5.

(a) Explain how a virus antigens are presented after phagocytosis. (3)



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(b) Explain the process by which an antibody is secreted in response to the presentation of a virus antigen. (3)

(c) Cells in joints, like the knee, produce the protein collagen.

One type of auto-immune disease is rheumatoid arthritis (RA). An individual's immune system targets their own cells when they have an auto-immune disease. Joint pain, edema, and stiffness are all symptoms of RA.

A virus that produces a protein strikingly similar to human collagen has been discovered by scientists.

Explain how RA may arise from the immune system's reaction to this viral protein. **(2)**

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6.

(a) Define antigen? **(2)**

(b) Define antibody? (2)

A virus is the source of poliomyelitis.

A physician administered poliomyelitis vaccinations to a group of patients. Three months apart, he administered two doses of the vaccine to each patient.

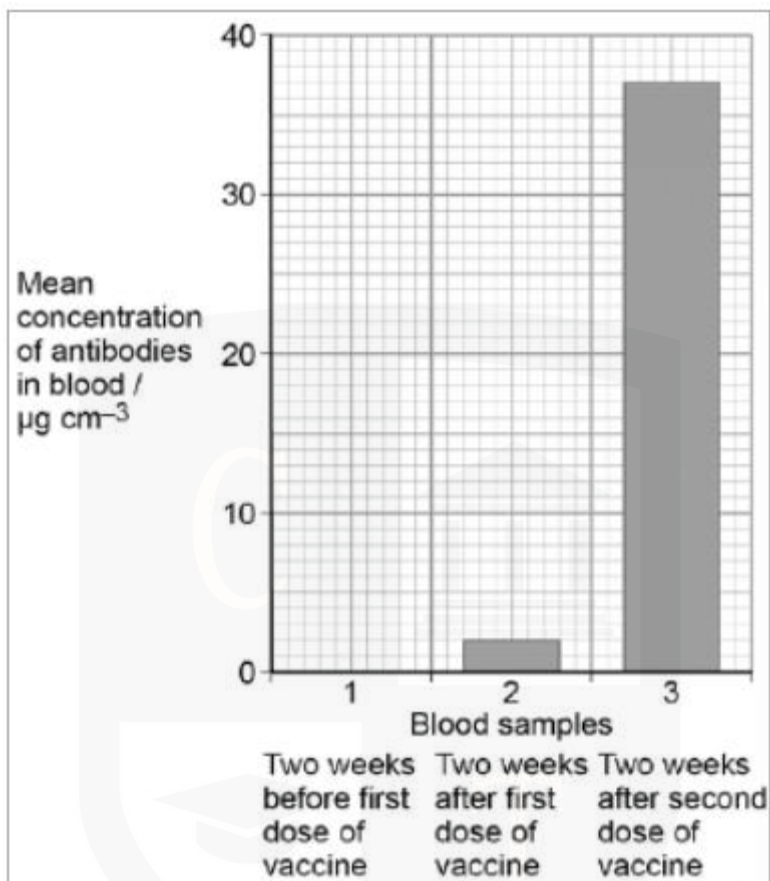
Three blood samples were tested by an immunologist from each patient:

- (sample 1) taken 2 weeks before the first dose of vaccine
- (sample 2) taken 2 weeks after the first dose of vaccine
- (sample 3) taken 2 weeks after the second dose of vaccine.

Every time, he took a reading of the patients blood to determine the level of antibodies against the poliomyelitis virus. The graph displays the results.

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(c) Determine the percentage increase in blood sample mean antibody concentration between samples 2 and 3. (1)

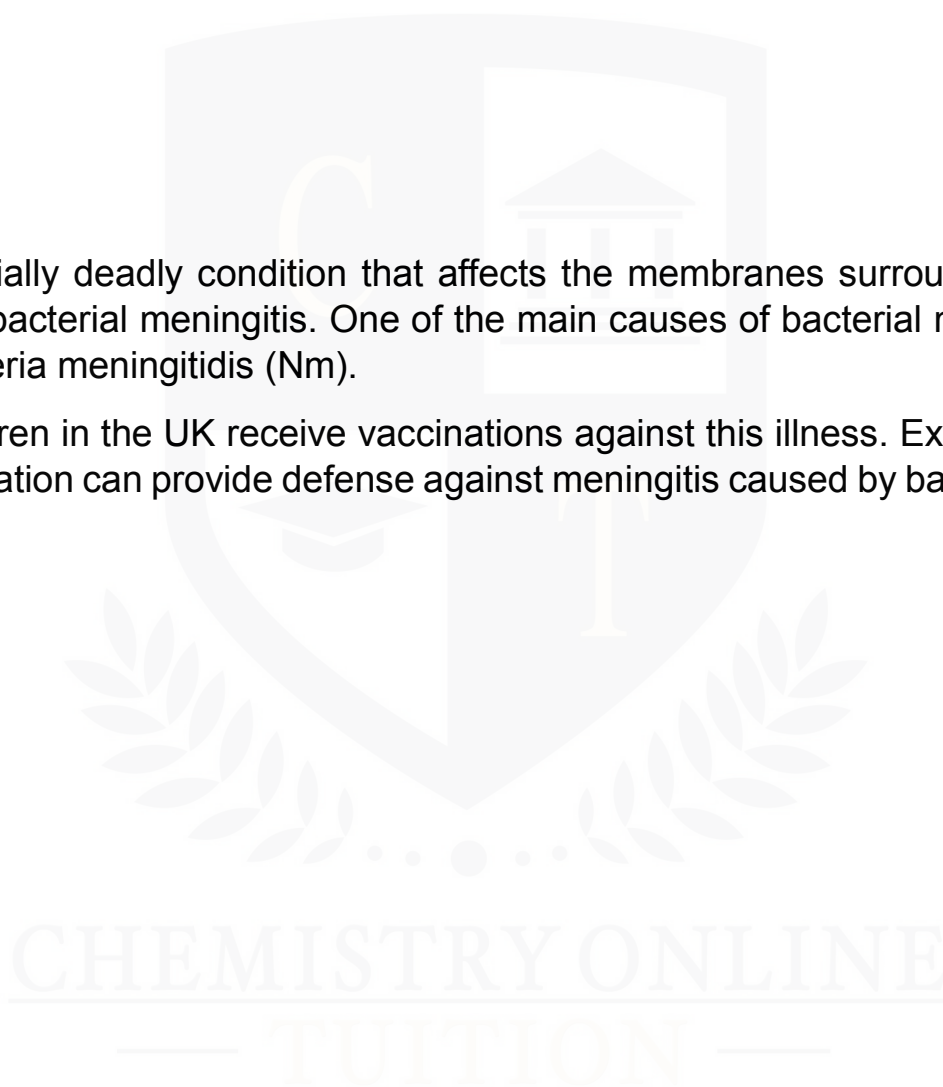
Answer = _____ %

(d) Describe the variations in the mean antibody concentrations found in blood samples 1, 2, and 3. (4)

7.

A potentially deadly condition that affects the membranes surrounding the brain is bacterial meningitis. One of the main causes of bacterial meningitis is *Neisseria meningitidis* (Nm).

(a) Children in the UK receive vaccinations against this illness. Explain how immunization can provide defense against meningitis caused by bacteria. **(6)**



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8.

(a) An individual receives a vaccine, which causes their body to produce antibodies against the pathogen. Explain how. **(5)**

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(b) What distinguishes passive immunity from active immunity? **(5)**



DR. ASHAR RANA
M.B.B.S / MS. CHEMISTRY



- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
- Tutoring students in UK and worldwide since 2008
- CIE & EDEXCEL Examiner since 2015
- Chemistry, Physics, Math's and Biology Tutor

CONTACT INFORMATION FOR CHEMISTRY ONLINE TUITION

- UK Contact: 02081445350
 - International Phone/WhatsApp: 00442081445350
 - Website: www.chemistryonlinetuition.com
 - Email: asherrana@chemistryonlinetuition.com
- Address: 210-Old Brompton Road, London SW5 OBS, UK