DUNMAN HIGH SCHOOL
YEAR 4 BIOLOGY
INFECTIOUS DISEASES

13A

Name: .. .. [ ] Grade: .....

Class: .. Date: 8 May 2023

At the end of the worksheet, are you able to:

	Check (✓/✗)
state that a typical virus has a protein coat enclosing its genetic material and reproduces only in living host cells	☐
discuss how viruses challenge the cell theory and concepts of what is considered living	☐
state that vaccines contain an agent that resembles a pathogen and prevent infectious diseases by stimulating white blood cells to quickly produce antibodies when the pathogen invades	☐

Structured Questions

1 Figure 1 shows a bacteriophage, a virus that attacks bacteria exclusively.

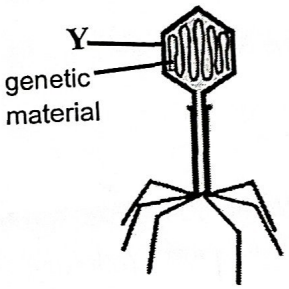

Figure 1

a) Identify structure **Y**.

Capsid ..... [1]

b) Explain why a virus is not considered a living organism.

Viruses cannot reproduce or carry out metabolic activities outside of a host cell. ..... [1]

c) State one similarity between a bacterium and a virus.

Both have genetic material ..... [1]

2 SARS-CoV-2 which causes COVID-19 is a virus which transmitted through respi droplets.

Figure 2.1 shows the steps of making a vaccine against the virus.

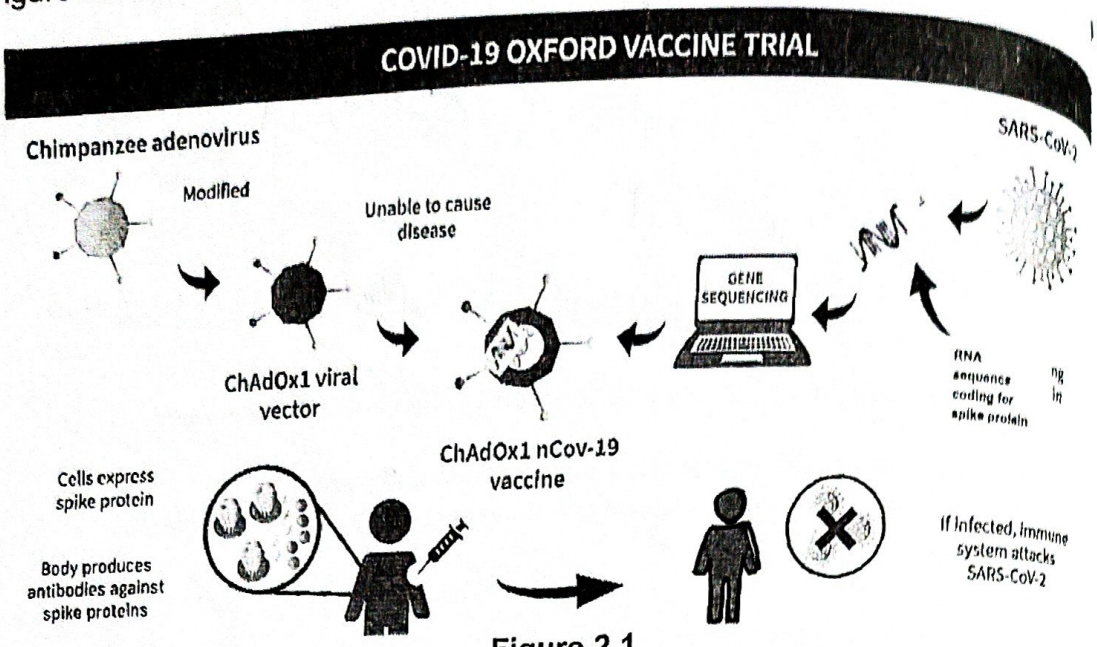

Figure 2.1

- Chimpanzee adenovirus (chAdox1 virus) is first modified to be used as a vector. The modified vector is no longer able to cause disease.
- The scientists sequenced the RNA for spike protein and inject into the modified vector which forms the vaccine.
- The vaccine is then injected into humans.
- When the vaccine enters human body cells, the body cells are made to express the spike proteins.
- The spike proteins are then released from the body cells.
- This stimulates the body to produce antibodies against the spike proteins.

a) What is vaccine?

A vaccine contains an agent that resembles a pathogen and prevents infectious diseases by stimulating white blood cells to quickly produce antibodies when the pathogen ~~invades~~ invades.

b) State one structure that is present in the virus but not in human cell.

Capsid

able to contain RNA

c) Suggest why a virus is suitable to be used as a vector for this vaccine.

It can trigger the body's secondary immune response.

To contain the gene, to allow the gene to be replicated

Safety: Although viral vectors are occasionally created from pathogenic viruses, they are modified in such a way to minimise the risk of handling them.

Figure 2.2 shows the chAdox1 viral vector and its RNA sequence entering the cell.

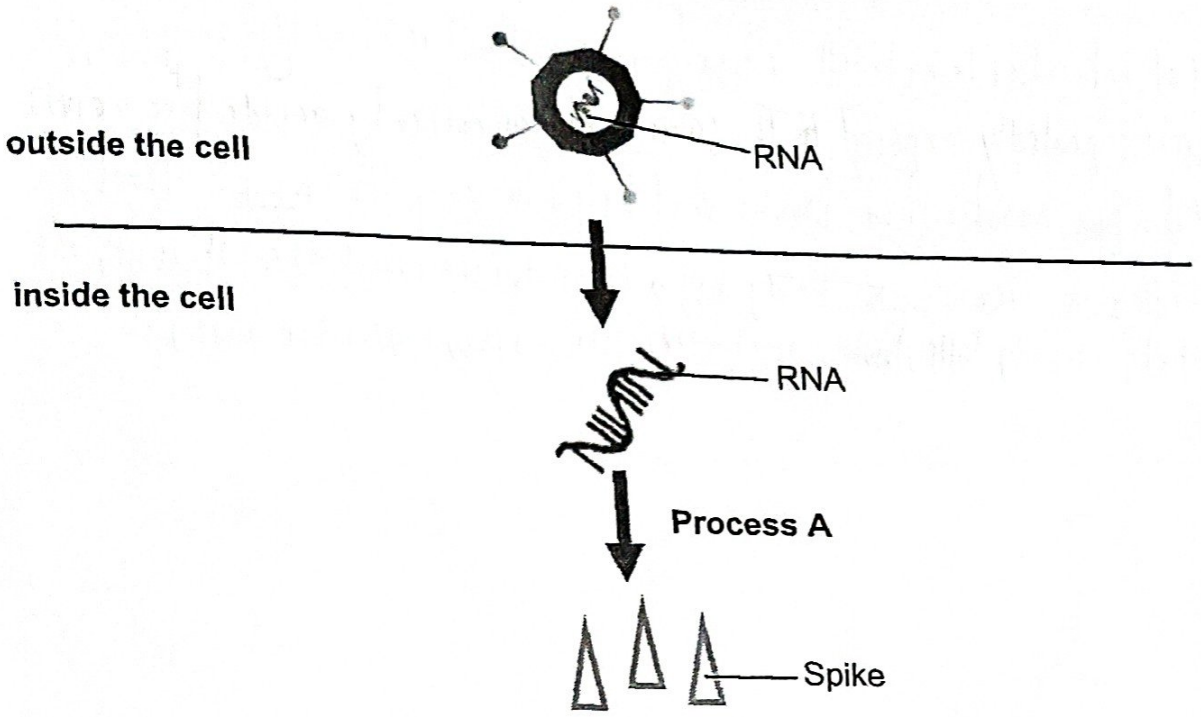

Figure 2.2

Name and outline process A which results in the formation of the polypeptide chain which eventually folds into the spike protein.

Process A is translation, which consists of 3 steps: initiation, elongation and termination. During initiation, ribosome attaches to mRNA and moves until it recognises the start codon AUG. tRNA molecule with anticodon complementary to AUG binds via complementary base-pairing to the mRNA AUG on mRNA codes for amino acid methionine. During elongation, tRNA carrying 2nd amino acid in the chain binds to the mRNA by complementary base pairing between the codon and anticodon. Peptide bond is formed between 2 amino acids. 1st tRNA drops off and mRNA is moved one codon through the ribosome. 3rd tRNA can now bind to mRNA. This process will continue until stop codon is ~~encoun~~ encountered. Elongation continues until ribosome encounters stop codon, and termination of translation is carried out by stop codons that help release polypeptide chain. (recognised by release factors) Ribosome dissociates from mRNA. [5]

e) State the cell that produces antibodies.

White blood cell [1]

f) Booster shots are usually administered after the first vaccination.

Explain why booster shots are required.

Level of antibodies being to fall as time passes and will remain high only if the person is repeatedly exposed to the same antigen, either by accident or as the result of a ~~pro~~ booster shot. Booster shot helps to keep the ~~level~~ level of antibodies in the body high. (If natural exposure does not occur, the amount of antibody falls slowly, sometimes reaching a low, unprotective level.)

marry Helen who is phenotypically normal.