

PEARSON EDEXCEL A-LEVEL BIOLOGY B • 9B10

BIOLOGY



EXAM QUESTION PACK

TOPIC 2: CELLS, VIRUSES AND REPRODUCTION OF LIVING THINGS
VIRUSES

SCORE

/93

PERCENTAGE

%

STEMUP

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Q1.

An experimental drug called Zmapp was used to treat patients during this outbreak of Ebola virus.

Patients with Ebola virus were randomly split into two groups.

Both groups received standard medical treatment.

One group was also given Zmapp on days 1, 3 and 5.

Some of the patients suffered severe side effects after treatment with Zmapp and required additional medical care.

The results are shown in the table.

Day	Number of patients surviving		Number of patients with severe side effects after treatment with Zmapp on days 1, 3 and 5
	Without Zmapp	With Zmapp	
1	35	36	11
2	32	33	
3	31	31	7
4	30	29	
5	29	28	3
6	26	28	
7	23	28	
8	22	28	
9	22	28	

Analyse the data to assess the effectiveness of Zmapp to treat patients with Ebola virus.

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(Total for question = 4 marks)

Q2.

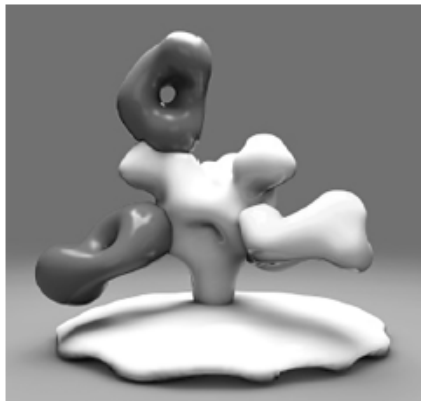
In 2014, the British nurse Will Pooley contracted Ebola. He was given the experimental drug Zmapp and he recovered.

Zmapp contains three monoclonal antibodies that bind to Ebola glycoprotein.

Changes to viral proteins are essential for fusion of the virus with the host cell membrane.

This process delivers the viral RNA into the cell cytoplasm.

The model shows how the three monoclonal antibodies bind to the Ebola glycoprotein.



(i) Analyse the information to explain the success of Zmapp in treating patients with Ebola.

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(ii) The rate of mutation in the Ebola virus is as fast as that of the influenza virus.

The Ebola genome codes for seven proteins, one of which is the glycoprotein.

Explain what effect a mutation may have on the effectiveness of Zmapp.

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Q3.

Bacteria are the host cells for λ (lambda) phage viruses.

Which is a description of a λ phage?

(1)

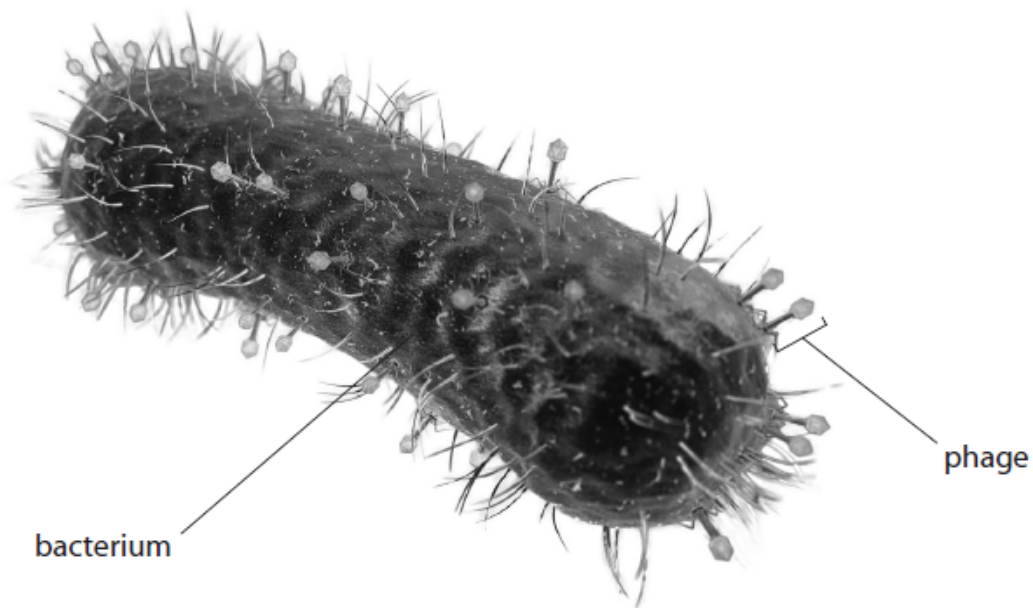
- ☐ **A** DNA virus with a complex protein capsid
- ☐ **B** DNA virus with a helical protein capsid
- ☐ **C** RNA virus with a complex protein capsid
- ☐ **D** RNA virus with a helical protein capsid

(Total for question = 1 mark)

Q4.

Bacteria are the host cells for λ (lambda) phage viruses.

The image shows phage viruses attacking a bacterium.



(Source: © nobeastsofierce Science/Alamy Stock Photo)

The length of this bacterium is $1.7 \mu\text{m}$.

Calculate the length of the labelled phage.

Give your answer in nanometres (nm).

(2)

Answer nm

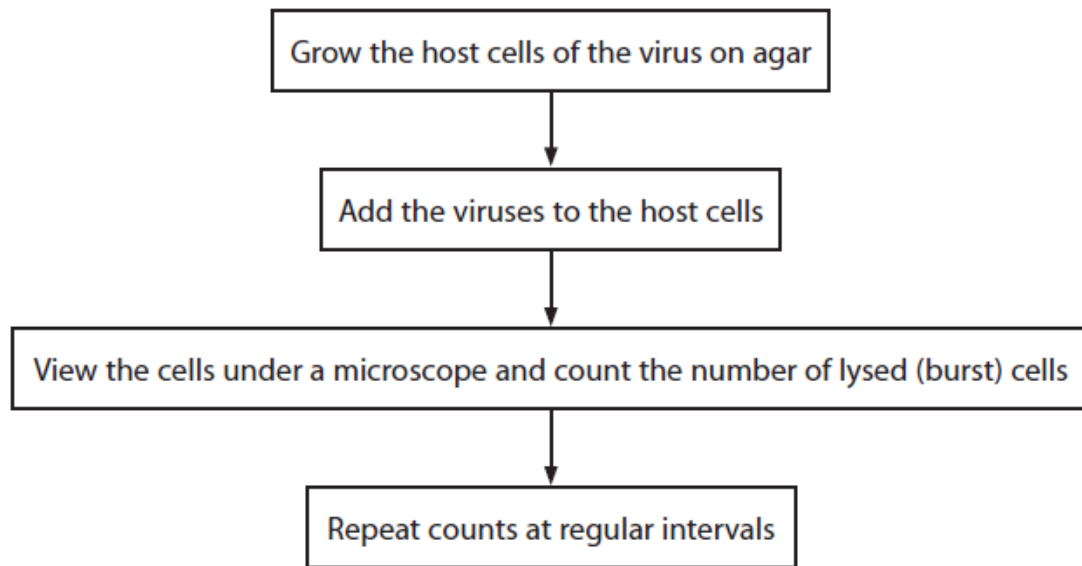
(Total for question = 2 marks)

Q5.

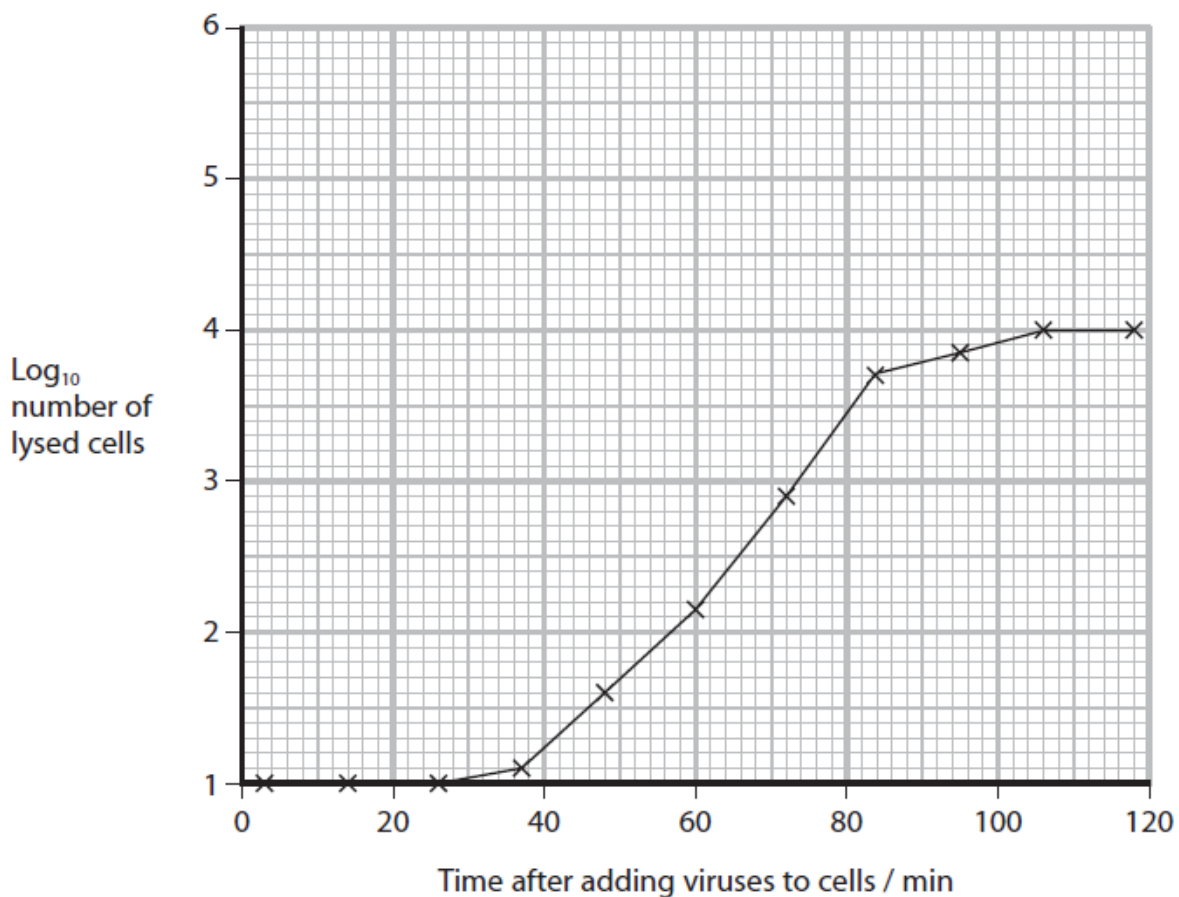
Bacteria are the host cells for λ (lambda) phage viruses.

Viruses can be cultured and a growth curve can be produced.

The flow chart shows how this can be done.



The graph shows a growth curve for viruses.



(i) Explain why there was a delay before the number of lysed cells started to increase.

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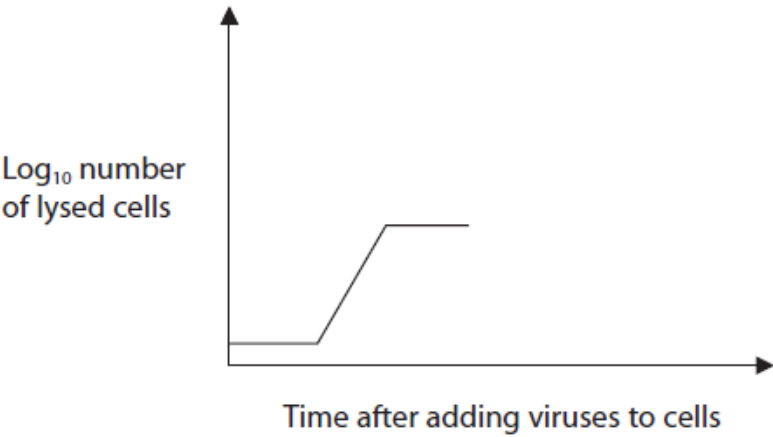
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(ii) Calculate the mean rate of increase in the actual number of lysed cells between 50 minutes and 90 minutes.

(2)

Answer cells min⁻¹

(iii) A sketch has been made of this growth curve.



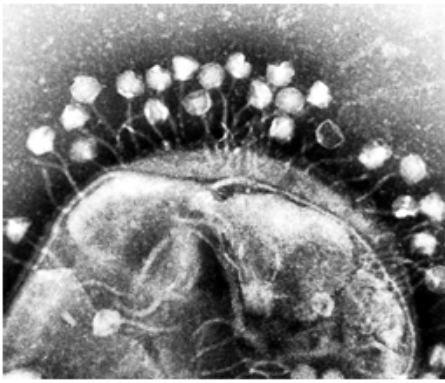
Complete this sketch to predict the shape of the growth curve after 120 minutes, assuming there is an excess of host cells.

(2)

(Total for question = 7 marks)

Q6.

The photograph shows part of a bacterial cell surrounded by viruses, as seen using an electron microscope.



(i) Which of these structures would be present in a bacterial cell but absent in a palisade mesophyll cell?

(1)

- ☐ **A** cellulose cell wall and nucleoid
- ☐ **B** cellulose cell wall and nucleolus
- ☐ **C** peptidoglycan cell wall and nucleoid
- ☐ **D** peptidoglycan cell wall and nucleolus

(ii) Which virus contains DNA?

(1)

- ☐ **A** Ebola
- ☐ **B** HIV
- ☐ **C** λ (lambda) phage
- ☐ **D** tobacco mosaic

(iii) Explain why an electron microscope, rather than a light microscope, was used to produce this photograph.

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(Total for question = 4 marks)

Q7. Human diseases can be caused by many different types of organism, such as bacteria and viruses.

(a) Give **two** differences between the genetic material of bacteria and viruses.

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(b) Tuberculosis (TB) is caused when droplets, containing the bacterium *Mycobacterium tuberculosis*, are inhaled into the lungs.

In the lungs, large numbers of the bacterium are formed rapidly. These can be ingested by macrophages. Eventually, tubercles (tissue masses), containing dormant bacteria inside macrophages, may form.

(i) Describe how macrophages ingest the bacteria.

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(ii) Suggest why treatment with antibiotics may not be effective against the dormant bacteria in the tubercles.

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(iii) TB can be prevented by vaccination. Explain how a person can develop artificial active immunity following vaccination.

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(c) In a person with TB, the dormant bacteria in tubercles may be activated after several years. The bacteria multiply rapidly, resulting in severe lung damage.

The bacteria are released from the tubercles. These bacteria can inhibit the activity of T cells and infect other organs.

Explain why the activity of these bacteria and the inhibition of T cells means that a person may quickly develop severe symptoms leading to death.

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(Total for Question = 13 marks)

Q8.

In 2014 there was an Ebola virus outbreak in West Africa.

Ebola virus begins its lytic cycle soon after the infection of body cells.

(i) Describe the lytic cycle of a virus.

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(ii) Some doctors believe that the Ebola virus may undergo latency within body cells.

State what is meant by the term latency.

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(Total for question = 4 marks)

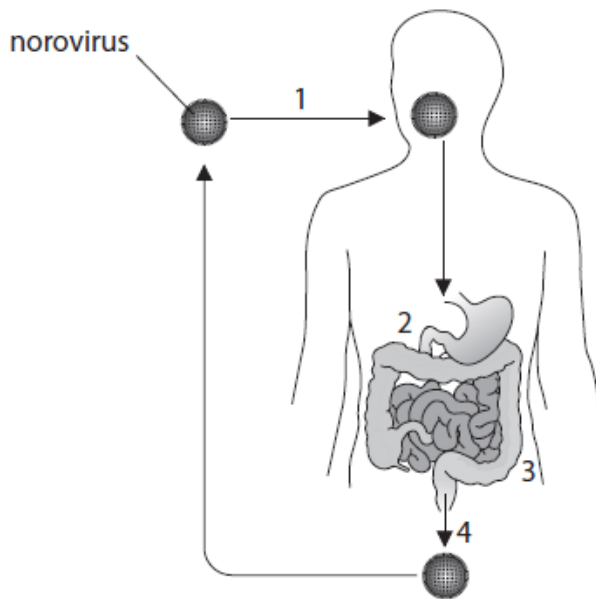
Q9.

Norovirus is a single-stranded RNA, non-enveloped virus.

Norovirus is the most common cause of gastroenteritis.

Norovirus is usually spread through the faecal-oral route.

The diagram shows the pathway that norovirus takes through the body.



- 1 The norovirus is transmitted in contaminated food or water.
 - 2 The norovirus passes through the stomach and into the small intestine.
 - 3 Some noroviruses are taken up by the cells of the small intestine.
 - 4 Some noroviruses pass out of the body in the faeces.
- This process only takes a few hours.

Describe what happens inside the cells of the small intestine that have taken up the norovirus.

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(Total for question = 3 marks)

Q10.

In 2014, the British nurse Will Pooley contracted Ebola. He was given the experimental drug Zmapp and he recovered.

Zmapp contains three monoclonal antibodies that bind to Ebola glycoprotein.

Changes to viral proteins are essential for fusion of the virus with the host cell membrane.

This process delivers the viral RNA into the cell cytoplasm.

The model shows how the three monoclonal antibodies bind to the Ebola glycoprotein.



Zmapp is an experimental drug. Although it has not undergone clinical trials, animal testing has shown it to be effective.

Explain why the use of Zmapp to treat Will Pooley had ethical implications.

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Q11.

Infections caused by *Chlamydia* and human papillomavirus (HPV) are sexually transmitted.

The HPV is a non-enveloped DNA virus.

Chlamydia infection is caused by the bacterium, *Chlamydia trachomatis*.

Compare and contrast the structure of a bacterial cell with the structure of HPV.

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(Total for question = 3 marks)

Q12.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

In 2014 there was an Ebola virus outbreak in West Africa.

Which of the following viruses contains RNA and the enzyme reverse transcriptase?

(1)

- ☐ **A** Ebola virus
- ☐ **B** human immunodeficiency virus (HIV)
- ☐ **C** λ (lambda) phage
- ☐ **D** tobacco mosaic virus

Q13. Bacteria and viruses can cause human diseases.

(a) Distinguish between the structure of bacteria and viruses

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(b) Infection with a bacterium can result in the development of active immunity to that bacterium. This results in the production of antibodies by plasma cells.

(i) Describe how infection with a bacterium results in the production of plasma cells.

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(ii) Explain how antibodies help a person to recover from an infection.

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(iii) A person who has had an organ transplant has to take immunosuppressive drugs. This prevents the immune system from destroying the organ transplant. Some of these drugs work by inhibiting the production of cytokines.

Suggest what effect these drugs could have on a person infected with a bacterium or a virus.

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(Total for Question = 13 marks)

Q14.

The classification of viruses is based on their structure and the type of nucleic acid that they contain.

(a) Which of the following is a reason why the influenza virus is classified as a retrovirus?

(1)

- ☐ **A** it has a capsid
- ☐ **B** it has an envelope
- ☐ **C** it contains RNA

☒ **D** it contains DNA

(b) Which of the following methods would be best for preventing the transmission of influenza through a population?

(1)

☒ **A** take paracetamol

☒ **B** wear a face mask

☒ **C** use insect repellent

☒ **D** take antibiotics

(c) Explain how the influenza virus has a pathogenic effect.

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(Total for question = 6 marks)

Q15.

Food poisoning can be caused by food that is contaminated with pathogenic microorganisms.

A number of different viruses can cause food poisoning.

One virus that can cause food poisoning is the Norovirus.

Noroviruses are RNA viruses.

(i) The following four statements are features of viruses:

1. have envelopes

2. contain reverse transcriptase
3. surrounded by a protein coat
4. have a helical structure

Which of the following is correct for all RNA viruses?

(1)

- ☐ **A** statement 1, statement 2 and statement 3
- ☐ **B** statement 2 only
- ☐ **C** statement 3 only
- ☐ **D** statement 1 and statement 4

(ii) Which of the following groups of viruses are also RNA viruses?

(1)

- ☐ **A** Ebola virus, human immunodeficiency virus and tobacco mosaic virus
- ☐ **B** Ebola virus, λ phage and tobacco mosaic virus
- ☐ **C** Human immunodeficiency virus, λ phage and tobacco mosaic virus
- ☐ **D** λ phage and tobacco mosaic virus

(Total for question = 2 marks)

Q16.

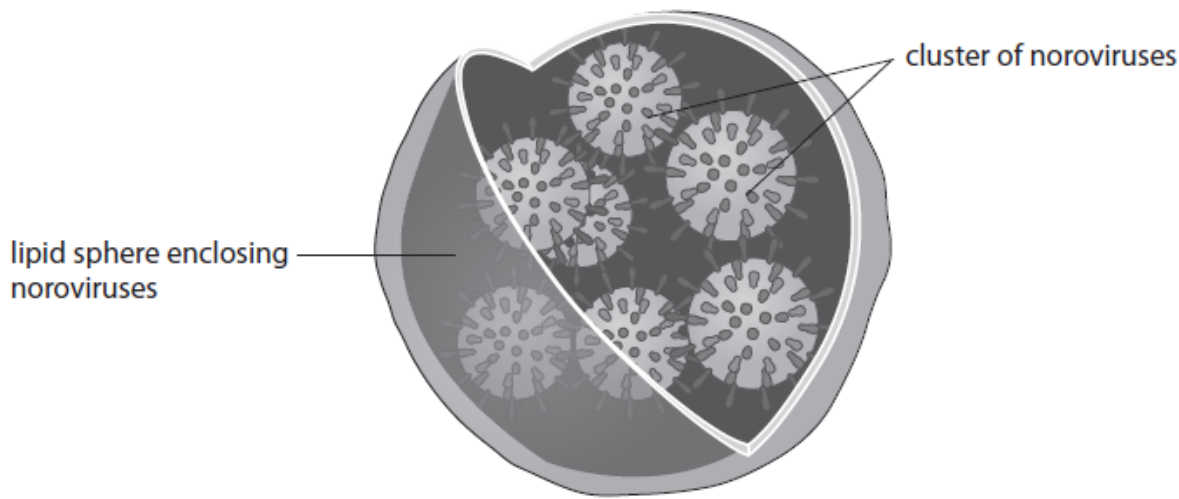
Norovirus is a single-stranded RNA, non-enveloped virus.

Norovirus is the most common cause of gastroenteritis.

Noroviruses can infect an animal as individual viruses or as a cluster of viruses inside a lipid sphere.

A cluster of viruses inside a lipid sphere is called a stealth sphere.

The diagram shows a stealth sphere.



(i) Animals infected with stealth spheres develop gastroenteritis very quickly and with severe symptoms.

Animals infected with individual noroviruses develop gastroenteritis more slowly and with less severe symptoms.

Analyse the information to explain these findings.

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(ii) Scientists are hoping that new treatments for norovirus infections can be developed to target the stealth sphere.

Analyse the information to explain how targeting the stealth sphere could be used to treat these infections.

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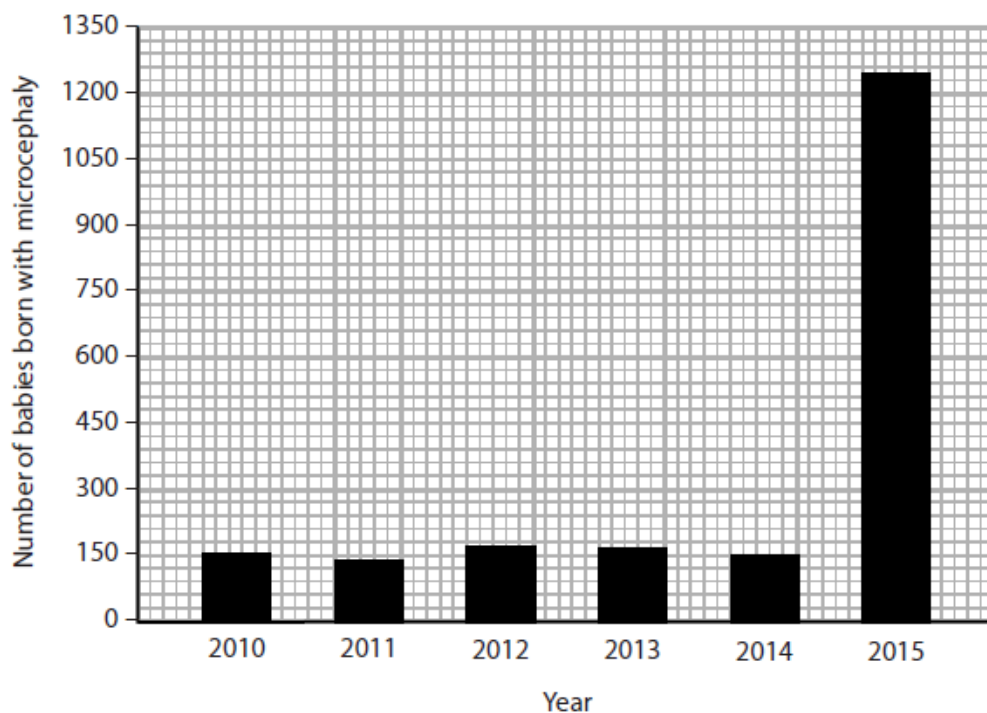
(Total for question = 5 marks)

Q17.

In February 2016, the World Health Organisation (WHO) declared a public health emergency because of the spread of the Zika virus.

The mild symptoms, such as joint pains, headaches and a slight temperature increase lasted only a few days. However, Zika virus has been linked to a birth defect called microcephaly.

The graph shows the number of babies born with microcephaly in Brazil from 2010 to 2015.



Scientists have discovered that the Zika virus genome is made of RNA.

This RNA codes for:

- capsid protein with 105 amino acids
- pre-membrane protein with 187 amino acids
- envelope protein with 505 amino acids
- seven nonstructural proteins

(i) State how many bases are needed to code for the capsid protein.

(1)

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(ii) Unlike human immunodeficiency virus (HIV), Zika is not a retrovirus.

Describe what happens to the Zika RNA once it is in the cell.

(2)

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(Total for question = 3 marks)

Q18.

Viruses possess some of the features of living organisms.

(i) Which of the following are found in **all** viruses?

(1)

- ☐ **A** DNA and protein
- ☐ **B** RNA and protein
- ☐ **C** nucleic acid and protein
- ☐ **D** nucleic acid and ribosomes

(ii) Which of the following is a retrovirus?

(1)

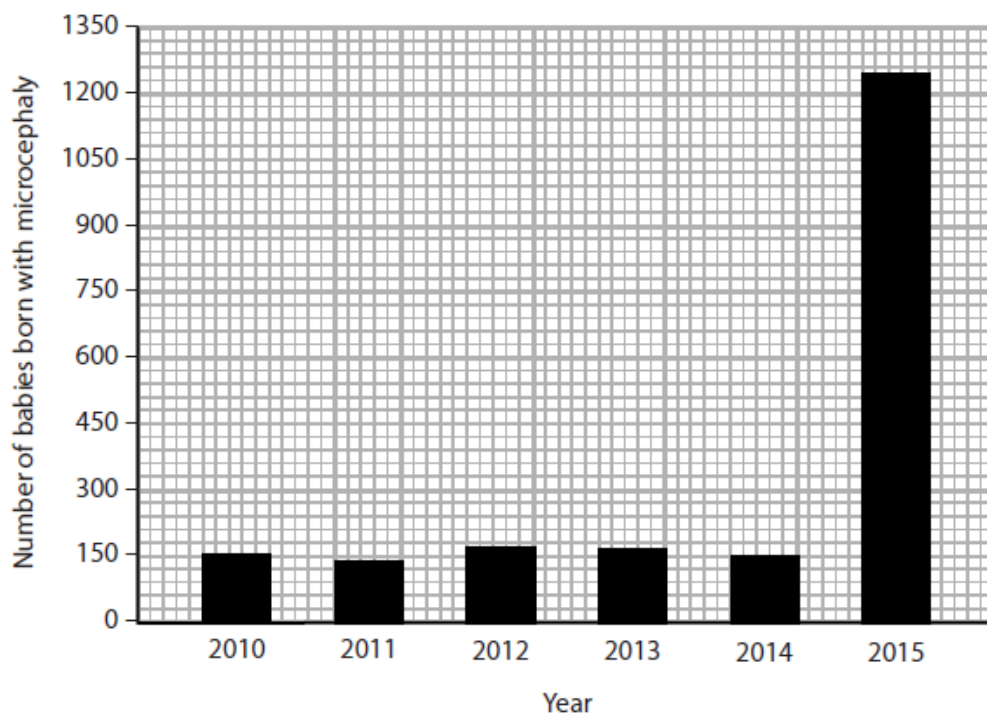
- ☐ **A** Ebolavirus
- ☐ **B** human immunodeficiency virus
- ☐ **C** λ (lambda) phage
- ☐ **D** tobacco mosaic virus

Q19.

In February 2016, the World Health Organisation (WHO) declared a public health emergency because of the spread of the Zika virus.

The mild symptoms, such as joint pains, headaches and a slight temperature increase lasted only a few days. However, Zika virus has been linked to a birth defect called microcephaly.

The graph shows the number of babies born with microcephaly in Brazil from 2010 to 2015.



Zika virus is transmitted to humans by infected mosquitoes.

(i) Explain why another type of drug, rather than antibiotics, has to be used to treat Zika virus infections.

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(ii) Scientists have suggested that genetically modified (GM) mosquitoes could be used to help combat the spread of the Zika virus.

Mosquito eggs are injected with DNA, from GM mosquitoes. This DNA contains a gene for fluorescence. However, only one in a few thousand injected eggs results in a GM mosquito.

Explain how this procedure could help in the production of large numbers of GM mosquitoes.

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(iii) Explain why the Brazilian government has advised people to use mosquito nets, even if they have already contracted the Zika virus.

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(Total for question = 8 marks)

Q20.

Describe two ways in which viruses replicate.

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to four of the following: • Zmapp is effective / more people survive when treated (1) • Zmapp has {little / no} effect up to {5/6} days /deaths rates are the same up to day {5/6} / Zmapp is effective after day {5/6} (1) • 3 doses / treatments are needed (1) • Zmapp side effects decrease over time (1) • sample size is {small / age unknown / sex unknown / trial only lasted nine days (1)	ACCEPT deaths with Zmapp level off at 28 ACCEPT no more deaths after 3 doses ACCEPT converse	4

Q2.

Question Number	Acceptable Answer	Additional guidance	Mark
(i)	An explanation that makes reference to the following: - the three antibodies in Zmapp each bind to a specific part of the viral glycoprotein (1) - therefore the protein cannot change shape and fuse the cell membrane (1) - therefore Ebola RNA cannot enter the cell and the virus cannot replicate (1)		(3)

Question Number	Acceptable Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to the following: - if mutation causes a change in the shape of the glycoprotein, Zmapp may not bind and will not be effective (1) - if mutation occurs in one of the other genes, the shape of the glycoprotein will not be affected and Zmapp will still be effective (1)		(2)

Q3.

Question Number	Answer	Additional Guidance	Mark
	The only correct answer is A B is incorrect because the capsid is complex not helical C is incorrect because DNA is the genetic material not RNA D is incorrect because DNA is the genetic material not RNA		(1) COMP

Q4.

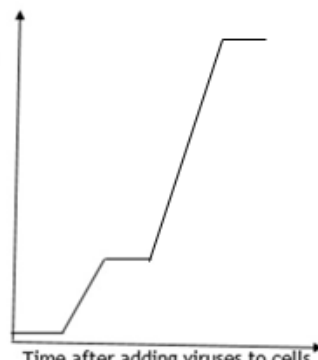
Question Number	Answer	Additional Guidance	Mark
	- drawing length of bacteria given in μm or nm / drawing length of virus given in μm or nm OR - ratio of drawing length (1) - actual length of virus given in nm, to the nearest whole number, value between 103 and 143 (1)	ACCEPT between 95 000 μm / 95 000 000 nm and 115 000 μm / 115 000 000 nm for bacteria between 7 000 μm / 7 000 000 nm and 8 000 μm / 8 000 000 nm for virus ACCEPT between 95 mm and 115 mm for bacteria and between 7 mm and 8 mm for virus ecf if numerals correct but order of magnitude wrong	(2) EXP

Drawing length of bacteria / mm	Drawing length of bacteria / μm or nm	Length of virus / mm	Length of virus / μm or nm	Actual length of virus / nm	Bacteria drawing length: virus drawing length
95	95 000 or 95 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	125 143	95:7 13.571:1 95:8 11.875:1
100	100 000 or 100 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	119 136	
105	105 000 or 105 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	113 130	
110	110 000 or 110 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	108 124	
115	115 000 or 115 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	103 118	115:7 16.428571:1 115:8 14.375 :1

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following: - virus to attach to host cells / {genetic material / DNA} to enter host cells (1) - synthesis of DNA (1) {protein synthesis / transcription <u>and</u> translation} (1) - assembly of new viruses (1)	ACCEPT virus {enters / infects} DO NOT ACCEPT RNA IGNORE nucleic acid DO NOT ACCEPT RNA unless already penalised in mp 1 / in the context of {proviruses / latency} ACCEPT capsid / capsomeres / tail / base plate / tail (fibres) / collar / J protein / enzymes / protease / permease / other named proteins will need to be checked DO NOT ACCEPT reverse transcriptase / integrase NB ACCEPT (time for) {replication / multiplication} of the virus in correct context if no other marks awarded.	(3) EXP

Question Number	Answer	Additional Guidance	Mark
(ii)	- correct values read from graph and divided by the time (1) - mean rate calculated (1)	3.8 and 1.7 and a division by 40 / 0.0525 / 3.147 IGNORE ref to logs 156 ecf wrong time value but correct answer to whole number e.g. (30 mins) 209 Correct answer only = 2 marks	(2) EXP

Question Number	Answer	Additional Guidance	Mark
(iii)	- line going up and (generally) levelling off (1) - increase greater than the first increase (1)	IGNORE a third increase 	(2) EXP

Q6.

Question Number	Answer	Mark
(i)	The only correct answer is C <i>A is not correct because cellulose is not found in a bacterial cell</i> <i>B is not correct because cellulose and nucleoli are not found in a bacterial cell</i> <i>D is not correct because nucleoli are not found in a bacterial cell</i>	(1)

Question Number	Answer	Mark
(ii)	The only correct answer is C <i>A is not correct because Ebola contains RNA</i> <i>B is not correct because HIV contains RNA</i> <i>D is not correct because tobacco mosaic virus contains RNA</i>	(1)

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following: - the resolution is higher / better (1) - because wavelength of electrons is short(er) (1)	ACCEPT converse ACCEPT wavelength smaller	(2)

Q7.

Question Number	Answer	Additional Guidance	Mark
(a)	- bacteria have DNA, viruses have DNA or RNA ; - idea that bacteria have {circular / eq} genetic material, viruses have {linear / straight} ; - bacterial DNA is double-stranded, viral {DNA / RNA} is single (or double) stranded / eq; - bacteria (may) have plasmids, viruses do not have plasmids / eq;	NB piece answers together throughout Do not accept in context of plasmid	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	- reference to {phagocytosis / endocytosis / engulfing} ; - credit details of phagocytosis ; - reference to bacterium inside a {vacuole / vesicle / phagolysosome} ;	eg formation of {pseudopodia / membrane extensions around bacteria} / cytoplasmic streaming / binding to bacteria Not phagolysosome	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	- idea that bacteria need to be accessible to antibiotics ; - idea of bacteria inside macrophages ; - reference to waxy layer of (these) bacteria ; - idea that (bacteriostatic) antibiotics affect dividing bacteria; - reference to antibiotic resistance (of these bacteria) ;	Not bacteriocidal antibiotics	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	- idea of {dead / attenuated / eq} {organisms / pathogen / bacterium / eq} put into person; - reference to (stimulation of) {specific / primary} (immune) response ; - credit details of T helper cell activation ; - credit details of B cell activation ; - credit details of T killer cell activation ; - reference to production of memory cells ;	NB not simply crediting ref to vaccination as in stem of question Accept antigen eg macrophages as APCs eg involvement of cytokines, B cells as APCs eg involvement of cytokines, infected cells as APCs	(3)

Question Number	Answer	Additional Guidance	Mark
(c)	- reference to {further lung damage / severe breathing problems / eq} ; - idea that the <i>Mycobacterium</i> get into the {blood / lymph}; - idea that organ failure (leads to death) ; - idea of {reduced / weakened} immune response (due to a loss of T cells) ; - credit detail of role of T (helper) cells ; - credit detail of effect of no T killer cells ; - credit detail of effect of no B cells ; - ref to {secondary / opportunistic / other} infections (causing death) ;	eg cannot obtain enough oxygen eg production of cytokines eg infected cells will not be destroyed eg no antibody produced	(4)

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to the following: - viral proteins / capsids made (1) {viruses multiply / genetic material / RNA / DNA replicate} and {cells lyse / cells burst / viruses released from cell} (1)	ACCEPT viral RNA is translated	2

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to two of the following: - virus {nucleic acid / RNA / DNA / genome} incorporated / integrated (into the host cell) (1) - virus is {dormant / inactive} (1) - virus nucleic acid replicates when host cell divides (1)	ACCEPT virus is not virulent ACCEPT viral RNA is not translated ACCEPT viral DNA is replicated when host cell DNA is replicated	2

Q9.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to the following: (viral) RNA made (1) (viral) {capsid / protein} made (1) - assembly of viruses (1)	ACCEPT new virus particles made	(3)

Q10.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • it had not been shown to be safe or effective in humans (1) • however, scientists wanted to collect more data on drug therapy for Ebola (1) • it was ethical because Ebola has a very high death rate so its use could be justified as a last resort (1)		(3)

Q11.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: Similarities • both contain DNA (1) Differences • HPV is surrounded by {protein / capsid} and chlamydia by {a cellwall / peptidoglycan} (1) • HPV is hollow and chlamydia has {cell membrane / cytoplasm / ribosomes / glycogen granules / lipid droplets / plasmids}	ACCEPT DNA strands in HPV ACCEPT chlamydia has {cell membrane / cytoplasm / ribosomes / glycogen granules / lipiddroplets / plasmids} but HPV does not	(3)

Q12.

Question Number	Answer	Mark
	The only correct answer is B human immunodeficiency virus (HIV) <i>A is incorrect because Ebola virus does not have reverse transcriptase</i> <i>C is incorrect because lambda phage has DNA</i> <i>D is incorrect because tobacco mosaic virus does not contain reverse transcriptase</i>	1

Q13.

Question Number	Answer	Additional Guidance	Mark
(a)	1. bacteria are cells, viruses are {not / particles} ; 2. idea of bacteria surrounded by {cell wall / slime / capsule} , viruses surrounded by {protein / capsids / envelope} ; 3. bacteria have { plasmids / ribosomes / other named structure} , viruses do not have {plasmids / ribosomes / other named structure} ; 4. bacteria (genome) are DNA, viruses can be DNA or RNA ; 5. bacterial DNA is double-stranded, viral genetic material is single (or double) stranded / eq ; 6. idea that bacteria have {circular / eq} genetic material, viruses have {linear / straight} genetic material ;	NB piece answers together throughout Accept only matched structures 2. Accept for envelope: membrane / phospholipid layer / eq 3. Accept bacteria have membranes, flagella cytoplasm, glycogen, lipid droplets 6. Not in context of plasmid	(3)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. reference to humoral (immune) response ; 2. reference to {phagocytosis / eq} by {phagocytes / named phagocyte} ; 3. reference to macrophages as { antigen-presenting cells / APCs} (to T helper cells) ; 4. reference to B cells as { antigen-presenting cells / APCs} (to itself) ; 5. idea that T helper cells release cytokines for B cell {activation / stimulation} ; 6. idea of B cells {forming clones / dividing /eq} (to form B effector cells) ; 7. reference to {differentiation of B cells into plasma cells / formation of plasma cells from B cells} (subsequent to cloning) ;	2. Accept dendritic cells / Langerhans cells / B cells 3 Accept dendritic cells / Langerhans cells 4. Accept antigen binds to B cells 6. Not to form plasma cells	(4)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. reference to {opsonisation / antibodies bind to bacteria / eq} ; 2. (as a result) enhancing phagocytosis / eq ; 3. reference to {immobilisation / agglutination / eq } (of bacteria) ; 4. idea of antibodies neutralising toxins / eq ;	1. Not reference to killing bacteria 2. Accept easier, better	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	- idea that the immune response will be weaker ; - person may not recover from this infection / eq ; - idea of {other (opportunistic) infection / cancer} ; - reference to cytokines released from {T helper / CD4 } cells ; - idea that cytokines are involved in {activation / division } of {B cells / T killer cells} ; - credit consequence of impaired B cell function ; - credit consequence of impaired T killer cell function ;	1. Accept in context of either humoral or cell-mediated immune response 6. Accept e.g. no antibody produced by plasma cells 7. Accept e.g. infected cells not destroyed	(4)

Q14.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	C		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
(b)	B		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	An explanation that makes reference to the following: - virus can {bind to / infect} cells of {throat / lung} (1) - virus has {haemagglutinin / glycoprotein / receptors} (on its surface) (1) Plus two from: - detail of viral replication (1) - leads to cell {lysis / tissue} damage (1) - immune response is triggered which results in symptoms that include {fever / headaches / fatigue / sore throat} (1)		(4)

Q15.

Question Number	Answer	Mark
(i)	The only correct answer is C <i>A is not correct because not all RNA viruses have envelopes and only the retroviruses contain reverse transcriptase</i> <i>B is not correct because only the retroviruses contain reverse transcriptase</i> <i>D is not correct because not all RNA viruses have envelopes and they are not all helical</i>	(1)

Question Number	Answer	Mark
(ii)	The only correct answer is A <i>B is not correct because λ phage has DNA</i> <i>C is not correct because λ phage has DNA</i> <i>D is not correct because λ phage has DNA</i>	(1)

Q16.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following: - because more viruses delivered (1) - because {lipid / sphere} can pass through cell membrane / no need to bind to (cell) receptors / can bind to any cell (1) - because {lipid / sphere} protects viruses from {enzymes / stomach acid / phagocytes / immune system} (1) - credit a link between one reason and the information given (1)	e.g. more cells infected so symptoms develop faster more cells infected so symptoms are worse virus particles not destroyed so more cells infected	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to two of the following: - because the lipids could be {targetted / broken down} (1) - by an enzyme (that breaks down lipid) (1) - resulting in {fewer virus particles arriving at cells (in one go) / exposure to immune system} (1)	ACCEPT using a drug that can penetrate the lipid ACCEPT therefore destroying the viruses ACCEPT {fewer / no} viruses (arriving at the cells)	(2)

Q17.

Question Number	Answer	Additional Guidance	Mark
(i)	315		(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to the following: - used in translation to make (viral) protein (1) - more RNA is produced (1)		(2)

Q18.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	C (nucleic acid and protein)		(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	B (human immunodeficiency virus)		(1)

Q19.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: - because viruses are {not living / not cells / have no metabolism / have no protein synthesis organelles / lack a cell wall / lack peptidoglycan} (1) - antiviral drugs used because they inhibit replication (1)		(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of the following: - identify mosquitoes that fluoresce (1) - because these mosquitoes are {genetically modified / contain the gene} (1) - allow {those that fluoresce / GM mosquitoes} to interbreed (1) - repeat for several generations (1) - offspring with the gene for fluorescence are selected to produce a population of GM mosquitoes (1)	Do not accept eggs	(4)

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to two of the following: - to prevent (people with Zika) being bitten (1) - therefore preventing {spread of Zika / biting uninfected people / increase in infected mosquitoes} (1) - mosquitoes spread other diseases (1)		(2)

Q20.

Question Number	Acceptable Answer	Additional Guidance	Mark
	A description that makes reference to the following: Latency: • virus genetic material inserted into host cell and integrated into host DNA (1) • viral DNA replicated each time the host cell replicates (1) Lytic cycle:		(4)
	• virus genetic material inserted into host cell and synthesis of viral particles by host cell (1) • lysis of host cell (1)		