

Past-paper walk-through

Infectious diseases ■ 10.1

eXercise

Questions in this set

- 9700/11 N25 Q5 ■ 1 mark
- 9700/11 N25 Q36 ■ 1 mark
- 9700/11 N25 Q37 ■ 1 mark
- 9700/12 N25 Q38 ■ 1 mark
- 9700/13 N25 Q36 ■ 1 mark
- 9700/13 N25 Q37 ■ 1 mark
- 9700/14 N25 Q36 ■ 1 mark
- 9700/22 N25 Q2 ■ 12 marks
- 9700/24 N25 Q2 ■ 18 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 5

9700/11 N25 ■ Q5 ■ 1 mark

- 5** Which statement about viruses is correct?
- A** They are cells with a capsid made of phospholipids.
 - B** They are cells with a capsid made of protein.
 - C** They are particles with a capsid made of phospholipids.
 - D** They are particles with a capsid made of protein.

Solution 5

Answer: **D**

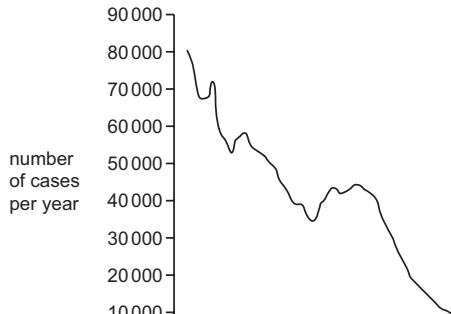
Why

- A virus is not a cell at all – it has no cytoplasm, membrane or ribosomes.
- It is a particle consisting of nucleic acid inside a coat.
- That coat, the capsid, is built from protein subunits, not phospholipids.

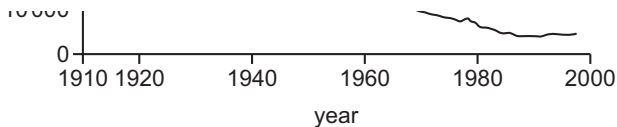
Question 36

9700/11 N25 ■ Q36 ■ 1 mark

- 36** The graph shows the decrease in cases of tuberculosis (TB) in a country between 1910 and 2000.



Question 36



Which factors could have contributed to the fall over this period?

- 1 pasteurisation of milk
- 2 the provision of new housing to reduce overcrowding
- 3 removing large pools of stagnant water
- 4 identification of contacts of people infected with TB

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

Solution 36

Answer: **A**

Why

- Better housing and nutrition reduce crowding and improve resistance to infection.
- Effective antibiotics and the BCG vaccination programme reduce cases directly.
- The fall begins well before antibiotics existed, so improved living conditions must be part of it.

Question 37

9700/11 N25 ■ Q37 ■ 1 mark

37 The pathogens for some diseases are transmitted by vectors.

Which disease is transmitted with the help of a vector that could be controlled by the removal of pools of water?

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

Solution 37

Answer: **C**

Why

- A vector is an organism that carries the pathogen between hosts.
- Malaria's vector is the *Anopheles* mosquito, which breeds in standing water.
- Draining pools removes the breeding sites; cholera is waterborne and the others need no vector.

Question 38

9700/12 N25 ■ Q38 ■ 1 mark

38 Which factors affect the global pattern of distribution of malaria?

- 1 the disease is mainly restricted to tropical and subtropical environments
- 2 the effective vaccine has eradicated the disease in many countries
- 3 the vector required for transmission of malaria parasites

	1	2	3
A	✓	✓	x
B	✓	✓	✓
C	✓	x	✓
D	x	✓	✓

key

✓ = effect

x = **not** an effect

Question 38



Solution 38

Answer: **C**

Why

- Malaria needs both a suitable climate and its mosquito vector, so 1 and 3 apply.
- There is no vaccine that has eradicated malaria anywhere, so 2 is false.
- That combination of climate and vector is what confines it to the tropics and subtropics.

Question 36

9700/13 N25 ■ Q36 ■ 1 mark

36 Which row correctly identifies the pathogens causing malaria and TB?

	malaria	TB
A	protocist	virus
B	protocist	bacterium
C	prokaryote	bacterium
D	prokaryote	virus

Solution 36

Answer: **B**

Why

- Malaria is caused by *Plasmodium*, which is a protoctist.
- Tuberculosis is caused by *Mycobacterium*, which is a bacterium.
- Neither is a virus, and a protoctist is eukaryotic, not prokaryotic.

Question 37

9700/13 N25 ■ Q37 ■ 1 mark

- 37** What could be used to help prevent an outbreak of cholera in a town?
- A** treatment of sewage waste
 - B** spraying still water with insecticides to kill mosquito larvae
 - C** increased use of antiviral medicine
 - D** preventing the reuse of hypodermic needles

Solution 37

Answer: **A**

Why

- Cholera is spread by the faecal–oral route, through water contaminated with sewage.
- So treating sewage breaks the transmission route.
- Insecticide targets mosquitoes (malaria), antivirals do not work on bacteria, and needles spread HIV.

Question 36

9700/14 N25 ■ Q36 ■ 1 mark

36 Infectious diseases may be caused by bacteria, protoctists and viruses. Different pathogens may be transmitted by airborne droplets, from faeces to mouth (faecal-oral), by sexual intercourse and by vectors.

Four examples of infectious diseases are listed.

- 1 cholera
- 2 HIV/AIDS
- 3 malaria

Question 36

4 tuberculosis

Which table classifies the four diseases correctly to show the type of pathogen that causes the disease and the mode of transmission?

A

	bacterium	protoctist	virus
droplet			2
faecal-oral	1		
sexual		3	
vector			4

B

	bacterium	protoctist	virus
droplet		2	
faecal-oral	1		
sexual			3
vector		4	

Question 36

C

	bacterium	protoctist	virus
droplet	4		
faecal-oral	1		
sexual			2
vector		3	

D

	bacterium	protoctist	virus
droplet	3		
faecal-oral		2	
sexual	1		
vector			4

Solution 36

Answer: **C**

Why

- Cholera is faecal–oral, HIV/AIDS is sexually transmitted, malaria needs a vector.
- Tuberculosis is spread by airborne droplets.
- Match each disease to its own route rather than assuming any pattern.

Question 2

9700/22 N25 ■ Q2 ■ 12 marks

2 Cholera is an infectious intestinal disease caused by a bacterial pathogen.

(a) Name the species of bacterium that causes cholera.

Question 2

(b) The World Health Organization (WHO) recommends a number of different approaches for the prevention and control of cholera. Two of these are:

- Authorities should provide access to safe drinking water.
- Individuals and communities should practise preventive personal hygiene.

Suggest **and** explain how these two approaches help in the prevention and control of cholera.

Question 2

- (c) Mass vaccination using an oral cholera vaccine (OCV) can be carried out in situations where there is a high risk of people developing the disease.

Passive immunisation involves transferring antibodies into a person for the prevention or treatment of an infectious disease. Some of the infectious diseases for which passive immunisation is available use monoclonal antibody. Passive immunisation for cholera using monoclonal antibody could be available in the future.

- (i) Complete Table 2.1 to compare an OCV and passive immunisation for cholera:

- fill in the empty box in **row 1**
- circle the correct answers from the choices given in **rows 3, 4 and 5**.

Table 2.1

row	feature	oral cholera vaccine	passive immunisation for cholera

Question 2

| | . . . | |

Question 2

1	component causing the desired response		antibody
2	type of immunity gained	artificial active	artificial passive
3	stimulates production of memory lymphocytes	yes / no	yes / no
4	length of time needed to have an effect	shorter same longer	longer same shorter
5	duration of immunity	shorter same longer	longer same shorter

[4]

- (ii) The production of monoclonal antibodies for treatment involves the formation of hybridoma cells from two different cell types

Question 2

hybridoma cells from two different cell types.

Question 2

Name the **two** types of cell that fuse to form a hybridoma cell **and** explain why this fusion is necessary.

Question 2

[Total: 12]

Solution 2

(a)

Mark scheme

- *Vibrio cholerae* ;
- must be spelled correctly
- 1
- 9700/22
- October/November 2025

Solution 2

(b) Mark scheme

- any four from:
- within general response, in correct context
- 1
- ref. to, contamination / contaminated ;
- A presence of, pathogen / V. cholerae / bacterium in correct context (can look for ora)
- 2
- ref. to breaking the transmission cycle ;

Solution 2

- providing access to safe drinking water
- 3
- cholera is transmitted by faecal-oral route ;
- A described e.g. ref. to (contaminated) faeces and ref. to, food washed in contaminated water
- or drinking (contaminated) water
- or eating (contaminated) food
- practise personal hygiene
- 4
- ref. to using method to make sure faeces do not enter drinking water ; e.g. use of, toilets / latrines

Solution 2

- A do not defaecate in or near, rivers / reservoirs / lakes
- AW
- accept urinate
- I non-scientific terms for, defaecation / urination
- 5
- washing hands ;
- 6
- detail ; e.g. use, soap / antibacterial gel / AW
- after, urination / defaecation A after going to the toilet
- before handling foodcontext is preparation or eating a meal

Solution 2

- scrub under fingernails
- cafes, restaurants / AW, provide places for washing hands
- do not share towels / use disposable towels / AW
- 7
- AVP ; e.g. water, is / should be, chlorinated / boiled / bottled / filtered to remove pathogens / UV-treated / other
- water, is / should be, kept separate from sewage / piped direct from water treatment plant
- keep fingernails short
- safe disposal of vomit
- 4

Solution 2

- 9700/22
- October/November 2025

Solution 2

(c)(i) Mark scheme

- antigen is a standalone mark then move to rows 3,4,5
- if no marks gained from rows 3,4,5, check for correct answers in these rows going down the column to award 1 mark
- row
- feature
- oral cholera vaccine
- passive immunisation
- for cholera

Solution 2

- 1
- component causing the
- desired response
- antigen(s) ; I weak / weakened / toxin
- A toxoid / inactivated toxin
- R dead antigen
- A weakened / attenuated / dead,
- pathogen / V. cholerae
- antibody
- 2

Solution 2

- type of immunity gained
- artificial active
- artificial passive
- 3
- stimulates production of
- memory lymphocytes
- yes / no
- yes / no ;
- 4
- length of time needed to

Solution 2

- have an effect
- shorter
- same
- longer
- longer
- same
- shorter ;
- 5
- duration of immunity
- shorter

Solution 2

- same
- longer
- longer
- same
- shorter ;
- 4
- $9700/22$
- October/November 2025

Solution 2

(c)(ii) Mark scheme

- B-lymphocyte / plasma cell / splenocyte, and, myeloma / tumour, cell ;
- A B-cell for B-lymphocyte
- A cancer cell for myeloma cell
- plus two from:
 - (B-lymphocyte) synthesises (specific / desired) / AW, antibody ; I has the antibody
 - (B-lymphocyte) cannot survive (for long) / dies, in culture ;
 - (myeloma cell) can divide / can carry out mitosis / long-lived ;
 - I rapidly / fast

Solution 2

- A plasma cell cannot divide
- R (hybridoma cell) divides uncontrollably
- 3
- 9700/22
- October/November 2025

Question 2

9700/24 N25 ■ Q2 ■ 18 marks

- 2** Cholera, malaria and tuberculosis (TB) are infectious diseases caused by unicellular organisms.
- (a)** For each of the diseases listed, state whether the disease is caused by a eukaryotic or prokaryotic organism.

Question 2

Question 2

Question 2

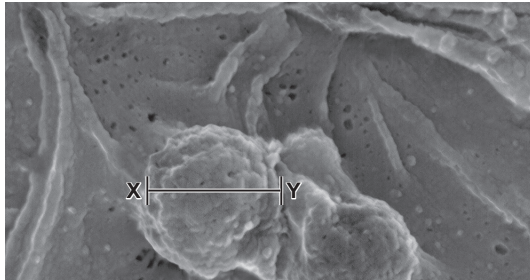
[1]

- (b)** State the term given to an organism that causes diseases such as cholera, malaria and TB.

Question 2

(c) Malaria is caused by species from the genus *Plasmodium*.

Ring cells are one stage in the complex life cycle of *Plasmodium* that are found within red blood cells. Fig. 2.1 is a scanning electron micrograph showing two ring cells, surrounded by the membrane of a red blood cell, which has just lysed (burst).



Question 2



Question 2

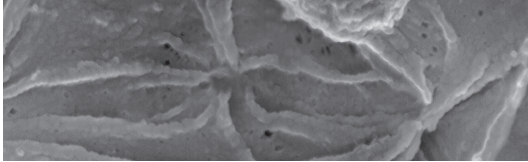


Fig. 2.1

- (i) The actual diameter of the ring cell along the length **X–Y** is $2\mu\text{m}$.

Calculate the magnification of the image shown in Fig. 2.1.

Give your answer to 3 significant figures.

Question 2

Question 2

- (ii) Describe how *Plasmodium* is transmitted from a person with malaria into the blood stream of an uninfected person.

Question 2

- (d) In a person with malaria, phagocytes destroy infected red blood cells. The phagocytes respond to the presence of particular molecules in the outer phospholipid bilayer of the cell surface membrane.

The cell surface membrane of a healthy, uninfected red blood cell shows an uneven distribution of types of phospholipid making up the bilayer (membrane asymmetry). For example, most of the phospholipid phosphatidylserine (PS) is located in the inner layer, facing the cytoplasm.

- (i) After a red blood cell is infected, a much higher proportion of PS is found in the outer layer of the cell surface membrane, facing blood plasma.

Suggest how the presence of PS in the outer layer can cause a response in a phagocytic cell.

Question 2

- (ii) Suggest why some **uninfected** red blood cells in a person with malaria can also be destroyed by phagocytic cells.

Question 2

- (e) Research has shown that *Plasmodium* uses cholesterol from the cell surface membrane of the red blood cell it has infected.
 - (i) Suggest why cholesterol is needed by *Plasmodium*.

Question 2

- (ii) The use of cholesterol by *Plasmodium* causes a decrease in the quantity of cholesterol in the cell surface membrane of the red blood cell.

Outline how a decrease in cholesterol could affect the cell surface membrane of the red blood cell.

Question 2

- (f) To achieve membrane asymmetry, which is an essential feature of a healthy cell, the red blood cell needs a supply of ATP and must maintain a very low concentration of calcium ions (Ca^{2+}) within the cytoplasm.

Table 2.1 shows details of three membrane enzymes that are involved in the movement of phospholipids between the inner and outer layers.

Table 2.1

key

PS = phosphatidylserine

PE = phosphatidylethanolamine

PC = phosphatidylcholine

} type of phospholipid

enzyme	enzyme action
flippase	hydrolyses ATP and moves PS and PE from the outer to the inner layer
scramblase	hydrolyses ATP and moves PS and PE from the inner to the outer layer

Question 2

floppase	hydrolyses ATP and moves PC from the inner to the outer layer
scramblase	after binding Ca^{2+} , randomly moves PS, PE and PC between layers

A healthy red blood cell has most PS and PE located in the inner layer and most PC located in the outer layer.

- (i) Phospholipids can occasionally move between layers without the action of an enzyme, so the continued activity of flippase and floppase is needed.

With reference to Table 2.1, explain why the action of the enzymes flippase and floppase involves the hydrolysis of ATP.

Question 2

- (ii) Blood plasma has a higher concentration of Ca^{2+} than the cytoplasm of red blood cells.

Suggest **one** way in which a red blood cell can have a very low concentration of Ca^{2+} when blood plasma has a higher concentration of Ca^{2+} .

Question 2

- (iii) The concentration of Ca^{2+} within the red blood cell increases when the cell is infected with the malarial parasite. This leads to the loss of membrane asymmetry.

With reference to Table 2.1, suggest **and** explain how membrane asymmetry is lost when the concentration of Ca^{2+} within the red blood cell increases.

Question 2

[Total: 18]

Solution 2

(a)

Mark scheme

- cholera = prokaryotic
- and
- malaria = eukaryotic
- and
- TB = prokaryotic ;
- 1

Solution 2

(b)

Mark scheme

- pathogen ;
- 1
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Solution 2

(c)(i) Mark scheme

- magnification ($\times$) 12 000 ;; for line X-Y measuring 24 mm
- A calculated values for line X-Y measured between 23 to 25 mm
- for one mark:
 - ■
 - correct calculation for 23.5 or 24.5 but not to 3 sig. figs = 1 mark
 - ■
 - incorrect answer e.g. conversion factor incorrect, but
 - —

Solution 2

- shows correct measurement for image
- —
- uses correct formula for calculation
- —
- answer to 3 sig. figs
- ■
- measurement 22 mm or 26 mm
- —
- correct answer for their measurement
- —

Solution 2

- uses correct formula for calculation
- –
- answer to 3 sig. figs
- 2

Solution 2

(c)(ii) Mark scheme

- any three from:
- 1 by a vector / carrier / mosquito / insect / (female) Anopheles ;
- 2 takes, blood meal / sucks blood / feeds on blood ;
- context is transmission from infected to uninfected
- 3 Plasmodium / pathogen / parasite, is in blood ; in correct context
- 4 injects Plasmodium / AW, together with, anticoagulant / saliva ;
- 5 AVP ; e.g. Plasmodium / AW, migrates, after ingestion / from insect gut / AW, to salivary glands

Solution 2

- if another mode of transmission stated, e.g. transfusion, allow mp1 and mp3 and a relevant AVP
- 3
- 9700/24
- October/November 2025

Solution 2

(d)(i) Mark scheme

- any two from:
- (phagocyte) has (specific) receptors (for PS) ;
- R antigens
- A named e.g. macrophage / monocyte / Kupffer cell / neutrophil
- PS binds to (phagocyte / cell surface) receptor (to stimulates a response) ;
- A phagocyte has a binding site for PS / PS binds to a binding site
- ref. to (PS presence / change in membrane) causes chemotaxis / attracts phagocyte (to red blood cell)

Solution 2

- treat as neutral suggested chemicals that trigger chemotaxis
- AVP ; e.g. PS acts as an antigen
- 2

Solution 2

(d)(ii) Mark scheme

- any one from:
- why uninfected red blood cells are destroyed
- (some) PS is present in outer layer so can be, recognised / detected ; AW
- why only some red blood cells are destroyed
- only a few PS in outer layer so lower chance of being recognised ;
- parts of, parasite / pathogen / Plasmodium (in circulation), may become attached to, surface / cell surface membrane ;
- (cell) displays, a foreign antigen / a non-self, antigen ;

Solution 2

- displays an antibody (attached to antigen) ;
- damaged (by other means) / at end of life-span / non-functioning, (so need destroying) ;
- 1

Solution 2

(e)(i) Mark scheme

- R if context is, red blood cell / entry into red blood cell by pathogen
- any one from:
- context is Plasmodium
- for, cell membrane(s) / cell surface membrane ;
- maintain / regulate, stability / fluidity, of membrane ;
- I affects / changes, if not qualified
- A phospholipid bilayer for membrane
- to, convert / AW, to other products needed ;

Solution 2

- to (breakdown and) use as an energy source ;
- cannot / does not have gene to, synthesise cholesterol ;
- AVP ; e.g. to form, vesicle / vacuole (to contain replicated cells)
- 1
- 9700/24
- October/November 2025

Solution 2

(e)(ii) Mark scheme

- 1 ref. to temperature
- any two from:
 - 1 make more fluid / increase fluidity ;
 - 2 decrease / reduces, membrane stability ;
 - 3 increases, entry / exit, of, polar molecules / ions / water ;
 - A increases, permeability / described
 - 4 allow increased (lateral) movement of cell components within bilayer ;
 - 5 reduced interaction with fatty acid tails ;

Solution 2

- 6 AVP ; e.g. decreased interaction with proteins, so affecting their function
- may affect ability to distort shape when passing through capillaries
- if no marks gained, allow one compensation mark for
 - ■
- changes two of: fluidity / stability / permeability
- ■
- ecf from 'decreases fluidity'
- 2

Solution 2

(f)(i) Mark scheme

- any one from:
- active / energy-requiring, process ;
- A need energy, for the process / to move phospholipids
- moving, phospholipids / named, against the concentration gradient / to area with higher quantity / AW ;
- to allow conformational change (of enzyme) ;
- I active transport but R if described as movement across the membrane
- 1

Solution 2

(f)(ii) Mark scheme

- any one from:
- actively transport / pump, Ca^{2+} / calcium ions, out of cell (once entered) ;
- transports Ca^{2+} / calcium ions, (out) against the concentration gradient ;
- cell surface membrane impermeable to, Ca^{2+} / calcium ions ;
- no / very few, transport / pump / carrier / channel, (membrane) proteins ;
- context is for entry of calcium ions
- 1
- 9700/24

Solution 2

- October/November 2025

Solution 2

(f)(iii) Mark scheme

- any three from:
- 1 scramblase, activated / becomes active / begins functioning / AW ;
- context is, increase in Ca^{2+} / when Ca^{2+} binds
- A Ca^{2+} increases, more scramblase binds to Ca^{2+}
- ora scramblase, suppressed / inactive (only), in low Ca^{2+} concentration
- 2 scramblase moves, PC from outer to inner layer or
- PE / PS, from inner to outer layer ;
- 1 scramblase randomly moves, PC / PE / PS

Solution 2

- 3 described effect on, distribution / organisation / asymmetry / AW (of phospholipids in cell surface membrane) ;
- e.g. becomes, disrupted / disorganised / more random
- is uncontrolled / not regulated
- becomes more, symmetrical / even / evenly balanced
- higher proportion of, PC in inner layer
- higher proportion of, PE / PS, in outer layer (than normal)
- (idea that the phospholipids are in the incorrect location)
- 4 scramblase activity higher than activity of, flippase / floppase
- or

Solution 2

- idea that, flippase / floppase, action cannot counteract effect of scramblase ;
- 5 ATP runs out, qualified ; e.g. to maintain asymmetry
- for (increased), flippase / floppase, activity
- to move phospholipids (against their gradient)
- 6 AVP ; e.g. Ca^{2+} is, a cofactor / needed for scramblase function
- 3
- 9700/24
- October/November 2025