10. Diseases and immunity

10.1 Diseases and immunity

Paper 3 and 4

Marking Scheme

Q1.

(a)	*any four from:* clean water supply ; (named) hygienic food preparation ; (examples of) general methods of cleaning ; (named) good personal hygiene ; (named) waste disposal ; correct storage of food ; prevention / removal, of pests ; AVP ;	**4**	e.g. use of disinfectant / sewage disposal / keep animals away from food / using gloves / ventilation / washing clothes
(b)	*any two from:* (contaminated) (named)surfaces / food / (named) animals / air / water / sewage ;;	**2**	

(c)	*any three from:* skin ; hairs in the nose ; tears ; mucus ; (named) white blood cells / platelets ; antibodies ; stomach acid ;	**3**	

Q2.

(a)	sneeze (may) contain (named) pathogens ; *idea of* pathogens being removed by washing hands ;	**2**	
(b)	*any two from:* boiling water / bottled water ; chlorinated water / UV steriliser / purification or sterilising tablets ; waste disposal / sewage treatment / separate drinking and toilet systems ; AVP;	**2**	**A** do not drink contaminated water e.g. microfiltration / remove water to stop mosquitoes breeding / AW
(c)	*any three from:* skin ; hairs in the nose ; mucus / ciliated cells ; stomach acid ; white blood cells / antibodies / phagocytosis ; tears ; AVP ;	**3**	**A** immune system e.g. platelets / blood clotting / increased body temperature / fever / ear wax
(d)	transmissible non–transmissible non–transmissible ;;	**2**	all three correct = two marks two or one correct = one mark

Q3.

(b)	*any one from:* to control / prevent, the spread of disease / AW ; removes, harmful organisms / pathogens / AW ; untreated sewage can cause bacterial infections / AW ; make water safe to drink ; AVP ; e.g. contaminate / kill, fish we eat	**1**	

Q4.

(a)	(loss of) watery faeces / AW ; oral rehydration therapy ;	**2**	
(b)	*any four from:* use hygienic food preparation methods ;; examples of hygienic food storage ;; (named example of) appropriate waste disposal ; good personal hygiene ; monitor or identify infected individuals / isolate infected individuals ; AVP ;	**4**	e.g. store food at correct temperature / cook food thoroughly / ref. to cleaning utensils or surfaces / avoiding cross contamination / pest-proof food storage

Q5.

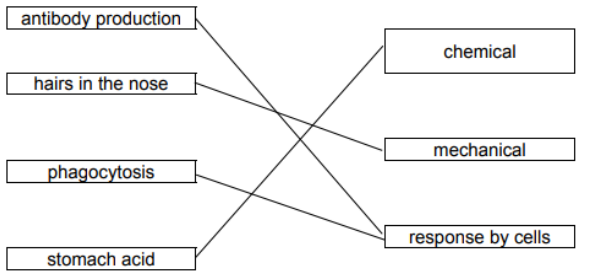
(a)	pathogen ; host ;	**2**	
(b)(i)	AIDS ;	**1**	
(b)(ii)	283 402 (people infected) ;	**1**	
(b)(iii)	bacteria ;	**1**	
(c)(i)	direct contact: blood indirect contact: air, animal, contaminated surfaces, food ;;	**2**	5 correct = 2 marks 4 or 3 correct = 1 mark 2 or 1 correct = 0 marks

(c)(ii)					**3**	one mark for each correct column

example of defence mechanism	cells	chemical	mechanical
antibody production	✓		
hairs in the nose			✓
mucus		✓	
phagocytosis	✓		
skin			✓
stomach acid		✓	

;;;

Q6.

(b)	disease ; blood ; food ;	3	
(c)	 ;;;;	4	**R** each additional line drawn

Q7.

(b)(i)	bacterium / bacteria ;	1	
(b)(ii)	loss of watery faeces / AW ;	1	
(b)(iii)	oral rehydration therapy ; intake of water containing, salt / ions, and sugar ; AVP ;;	2	
(c)	skin ; hairs in the nose ; mucus (traps pathogens) ; acid in the stomach ; white blood cells / phagocytosis / antibodies ;; AVP ;;	2	

Q8.

(a)	(a disease in which the) pathogen ; can be passed from one host to another ;	2	
(b)	boil ; chlorinate ; UV treatment ; sterilising, solution / tablets ; AVP ;	2	
(c)(i)	10 (%) ;;	2	
(c)(ii)	bacterium / bacteria ;	1	
(d)(i)	(loss of) watery faeces / AW ;	1	
(d)(ii)	oral rehydration therapy ; intake of water containing, salt / ions, and sugar ; AVP ;;	2	

Q9.

<table>
<tr><td>(a)(i)</td><td>1995 ;</td><td>1</td><td></td></tr>
<tr><td>(a)(ii)</td><td>195 (cases per 100 000 people) ;</td><td>1</td><td></td></tr>
<tr><td>(a)(iii)</td><td>(steady) increase (from 2003) ;
fluctuation between 2007 and 2009 / described ;
level off / plateau / AW, from 2009 ;
data quote with year and number including units ;</td><td>3</td><td></td></tr>
<tr><td>(b)</td><td>Campylobacter ;</td><td>1</td><td></td></tr>
<tr><td>(c)</td><td>rehydration / oral rehydration therapy ;</td><td>1</td><td>A water with, sugar and salt / electrolytes</td></tr>
<tr><td>(d)</td><td><table><tr><th>cellular</th><th>chemical</th><th>mechanical</th></tr><tr><td>phagocytosis</td><td>stomach acid</td><td>nasal hairs</td></tr><tr><td>antibodies</td><td>mucus</td><td>skin</td></tr></table>;;;</td><td>3</td><td>1 mark for each correct column</td></tr>
</table>

Q10.

(a)(i)	– 64 (%) / 64 (%) decrease ;;;	**3**	MP1 selection of values from the graph MP2 correct calculation to any number of sig figs **and** negative value indicated MP3 correct rounding to two significant figures ecf from previous MP if evidenced
(a)(ii)	*any five from:* 1 (vaccination confers) active immunity ; 2 (vaccine contains) weakened / inactivated / dead / AW, virus / pathogen ; 3 (vaccine) stimulates (primary) immune response ; 4 lymphocytes produce antibodies ; 5 antibodies, destroy / agglutinate / immobilise / kill, virus / pathogen ; 6 antibodies, mark / attached to, virus / pathogen, so phagocytes destroy them ; 7 production of memory cells ; 8 long-term immunity / AW ; 9 herd immunity / protecting unvaccinated people ; 10 person to person transmission interrupted / prevents the spread of polio through the population / AW ; 11 AVP ;	**5**	MP2 **A** vaccine contains antigen(s) MP11 e.g. antibodies, are specific / complementary, to antigen antibodies bind to virus
(a)(iii)	*any two from:* ref. to specificity (in context of antigen or antibody) ; antibodies (produced in response to the polio vaccine) have a complementary shape only to polio antigens ; antibodies bind only to polio virus ; *idea that* memory cells (produced by polio vaccine) are not activated by other pathogens ; AVP ;	**2**	

(b)	*total of three from:* (blood clot / scab) prevents entry of pathogens / pathogens trapped in mesh / (blood clot / scab) is a barrier to pathogens ; *max two from:* conversion of fibrinogen to fibrin ; conversion of soluble (protein) to, insoluble / fibrous (protein) ; forms, network of fibres / mesh ; ref to role of platelets ; formation of a scab ;	**3**	
(c)	plasma ;	**1**	

Q11.

(b)	drinking contaminated water / AW ;	1	
(c)	*any four from:* **1** cholera / bacterium / pathogen, produces a toxin ; **2** (toxin) causes secretion of chloride ions ; **3** into lumen / small intestine ; **4** (loss of ions) increases / AW, water potential within cell ; ora **5** water moves out of cells / blood ; **6** down water potential gradient / from high to low water potential ; **7** (out) by osmosis / through the partially permeable membranes ; **8** (causing) diarrhoea / watery faeces / AW ; **9** resulting in loss of water (from the body) ;	4	

(d)	*any six from* **1** *ref. to* active / long-term, immunity ; **2** vaccine contains weakened / dead / AW, bacteria / pathogen ; **3** *ref. to* antigens of pathogen ; **4** (antigen) stimulates an immune response ; **5** lymphocytes make antibodies ; **6** antibodies bind to, antigen ; **7** *ref. to*, specificity / complementary (shape to antigen / pathogen) ; **8** *ref. to* forming memory cells ; **9** *ref. to* mass vaccination (programmes) ; **10** person to person transmission interrupted / AW ; **11** AVP ;	6	

Q12.

(b)	placenta ;	1	
(c)(i)	6 / six ; lymphocytes ; 56 / fifty-six ; 3 / three ;	4	
(c)(ii)	*any two from:* 1 breastfeeding supplies antibodies before the baby starts making (enough of its) own ; 2 provides the baby with passive immunity ; 3 protection against / immunity from, infection / (named) pathogens / (named) diseases ; *4 idea that* it provides all the nutrients required by the baby ; 5 forms a bond (between mother and baby) ; 6 (stated) health benefit for mothers ; 7 milk at, the right temperature / body temperature ; 8 no need to prepare milk / sterilisation not required ; 9 AVP ;	2	e.g. free / provides bacteria for gut / (may) reduce chances of asthma *or* allergies *or* autoimmune diseases
(c)(iii)	*any two from:* passive immunity / antibodies from mother, during pregnancy / before birth / across the placenta ; vaccination *or* giving antigen(s) by, injection / mouth ; injection of antibodies ; (active immunity) following infection (by a pathogen) ;	2	

(d)	*any three from:* each (named) pathogen has antigens (on surface) ; ref. to specificity ; (shape) is complementary ; antibodies bind to antigens ; antibodies, mark pathogens for destruction / destroy pathogens ;	3	

Q13.

(b)(i)	–87(%) ;;;	3	Use **ecf** from each previous step throughout MP1: both correct readings from graph 760 and 100 MP2: correct answer calculated MP3: correct rounding to two significant figures
(b)(ii)	*any two from:* (overall) decrease in number (of lymphocytes during the 84 months) ; rapid decrease from 10 months and then, less steep / (eventually) levels off ; suitable description from graph ;	2	
(b)(iii)	*any four from:* fewer antibodies (produced by lymphocytes) ; decrease in immunity / inefficient immune system ; fewer memory cells ; any role of antibodies or lymphocytes (that will be impacted by fewer lymphocytes) ; develop AIDS ; example of (secondary) infection / disease / pathogen that may result from reduced number of lymphocytes ;	4	

Q14.

(a)(i)	*any two from:* ref. to passive immunity ; *idea of* immediate / fast, protection / response / AW ; AVP ; e.g. idea that gives time for immune system to produce own, antibodies / antitoxins	2	
(a)(ii)	*any three from:* ref. to active immunity ; (more) memory cells are produced ; long-term, immunity / protection ; after second injection higher concentration of antibodies than passive immunity ; reduces the chance of catching the disease (again) / AW ; response to second injection is, faster / greater, than first ; AVP ;	3	

(b)	*any four from:* pathogens have antigens ; antibodies, lock on to, antigens / pathogens ; antibody is specific (to antigen / pathogen) ; antibody has a complementary (shape) to antigen / AW ; antibody marks pathogen for, destruction by phagocytes / phagocytosis ; antibodies destroy pathogens / described ; AVP ;	4	
(c)	*any two from:* absorbs / transports, fat / fatty acids (and glycerol from lacteals) ; drains / AW, tissue fluid ; returns, fluid / lymph, to, blood / plasma ; AVP ;	2	

Q15.

(d)(i)	*any two from:* hairs in the nose ; skin ; AVP ;	**2**	
(d)(ii)	phagocytes ;	**1**	
(d)(iii)	(different) pathogens / antigens, have different / unique shapes ; pathogens have antigens ; lymphocytes, produce (specific) antibodies ; antibodies are, complementary / specific to, antigens ; antibodies, mark / destroy, pathogens ; ref. to memory cells ;	**3**	

Q16.

(a)	bacteria ;	**1**	
(b)(i)	*any one from:* weakened / dead / AW, bacteria / pathogen ; antigen(s) (of the pathogen) ; AVP ;	**1**	
(b)(ii)	*any three from:* *idea that* the immune response takes time to occur ; lymphocytes release antibodies ; ref. to (lymphocytes) produce specific antibodies to the (cholera) antigens / AW ; memory cells (form) ; long-term immunity ;	**3**	
(b)(iii)	*idea that* they did not have (active) immunity / memory cells before the start of the study / AW ;	**1**	

(b)(iv)	*any two from:* more, pathogens / diarrhoea / fever, in non-vaccinated group ; **ora** some vaccinated people did get symptoms so vaccine not 100% effective ; **ora** comparative data quote between vaccinated and not vaccinated ; AVP ;	**2**	
(c)(i)	*any four from:* cholera / pathogen, releases toxin ; (toxin) causes (more) chloride released (into small intestine) ; lowering water potential (in lumen) ; ref. to, osmosis / movement of water (into the lumen) ; (diarrhoea is) loss of watery faeces ; loss of salts / loss of minerals / dehydration ;	**4**	
(c)(ii)	*any two from:* oral rehydration therapy ; drink mixture of, sugar / nutrients and, salt / ions ; replace lost, water / fluids ; AVP ;	**2**	

Q17.

(c)(i)	chloride ;	1

(c)(ii)	*any four from:* loss of water ; by osmosis / down water potential gradient ; diarrhoea ; dehydration ; loss of other, (named) ions / salt(s) ; AVP ;	4

Q18.

(g)	*any two from:* (contaminated) blood transfusion ; sexual fluids ; breast feeding ; blood to blood contact ; AVP ;;	2

Q19.

(a)	**Q** / pathogen, are recognized as foreign ; **Q** / pathogen, will have specific / unique / AW, antigen ; **S** and **R** are white (blood) cells ; **S** / lymphocytes, make antibodies ; **T** are antibodies ; **T** / antibodies are as specific shape / complementary to, antigen / pathogen / Q ; **T** / antibodies bind to, antigen / pathogen / Q ; ref. to forming memory cells ; ref. to, active / long-term, immunity ; **R** / phagocytes, engulf, pathogens / antigens ; **R** / phagocytes, have enzymes / digest pathogens OR antigens ; **AVP** ;	6	
(b)	*support of conclusion:* general decrease, from 1942 / vaccination ; cases do not return to pre-vaccine levels / AW ; no cases from 1974 ; *against conclusion:* number of cases increased, (during the 2 years) after the vaccine was introduced / until government made its conclusion ; took 32 years after vaccine introduced before no cases of disease ; but there are (small) peaks (in cases) / fluctuation (in cases) ; comparative data quote ;	4	

Q20.

(d)(i)	*any four from:* contains antibodies / ref. to colostrum / provides protection against, pathogens / diseases / microorganisms ; provides passive immunity ; nutrient requirements met / change with age / change with development ; easy to digest / AW ; no additives / less risk of allergies ; sterile / less risk of infection / AW ; is at, body / correct, temperature ; no preparation / always available / convenient ; bonding with mother / AW ; free / cheap ; idea of volume is controlled / no over-feeding ; AVP ;	**4**	
(d)(ii)	*any two from:* water needed to, produce breast milk / stay hydrated / AW ; alcohol can pass to the baby in breast milk / AW ; alcohol can harm / delay development of, baby / AW ; AVP ;	**2**	

Q21.

(a)	(named) mechanical (barriers) ; (named) chemical barriers ; ref. to active immunity ; white blood cells / lymphocytes / phagocytes ; (phagocytes) engulf (named) microorganisms / phagocytosis ; lymphocytes produce antibodies ; ref. to specific, antigens / pathogens ; ref. to long term immunity / memory cells ; AVP ;	**5**	

Q22.

(b)	introduces harmless form of pathogen / AW ; ref. to antigen(s) ; stimulates an immune response ; ref to active immunity ; lymphocytes produce antibodies ; (lymphocytes develop into) memory cells ; memory cells, remain in the body / give long-term immunity / can produce antibodies (at a later time) ; respond quickly when an infection (of the same pathogen) occurs / before symptoms occur ; AVP ;	**4**	

Q23.

(a)(i)	reflex (action) ;	**1**	
(a)(ii)	contains antibodies / passive immunity / *idea of* fighting infections ; bonding with mother /AW ; is at a suitable body temperature ; sterile / less risk of infection / contamination ; convenience / always available / no preparation ; cheap / free ; easy to digest / less risk of colic / less risk of diabetes in child ; no additives / less risk of allergies ; *idea of* volume is controlled / no over-feeding ; nutrient requirements met / change with age / change with development ; AVP ;;	**4**	