

Q1.

2 (a)

*Award one mark per column. No penalisation for complete lack of all crosses (or all ticks) unless mixture of x and ✓ missing as agreed*

statement	emphysema	tuberculosis	obesity	rickets	smallpox
eliminated by vaccination	x	x	x	x	✓
a worldwide infectious disease	x	✓	x	x	✓ or x
a form of malnutrition	x	x	✓	✓	x
a deficiency disease	x	x	x	✓	x
involves degeneration of lung tissue	✓	✓ or x	x	x	x

[Total 5]

Q2.

(d) variable region;  
binding region to antigen;  
shape is specific to, cholera toxin / antigen;  
complementary;  
ref to R groups on amino acids (in polypeptide / protein);  
different, sequences of amino acids / primary structures;  
ref to, folding of the molecule / secondary structure / tertiary structure; [max 3]

(e) poor sanitation / no treatment of faecal waste;  
contamination of (drinking) water supply;  
poverty / poor living conditions / poor hygiene / poor (health) education;  
  
ref to natural disasters; e.g. assistance / aid / medical help / AW, cannot arrive in time  
  
no rehydration therapy available (at time when needed);  
no (effective) vaccine;  
further detail; (bacteria live in gut, where immune system is not effective) [max 3]

Q3.

- 5 (a) female Anopheles mosquito ;  
*either* takes blood meal / AW, from infected person or parasites enter mosquito in blood meal from infected person ;

takes blood meal / AW, from uninfected person ;  
parasite / pathogen / plasmodia, transferred in mosquito's, saliva / anticoagulant ;  
ref. to transfusion malaria / congenital or mother-foetus malaria / needle sharing / needle stick injury for max 1 ; [3 max]

- (b) (i) (protein is) antigen ;

*following vaccination*

(clonal) selection for, appropriate / corresponding / specific, B cell ;  
clonal expansion / divide (by mitosis) (to form B cell clone) ;  
memory cells ;

*on infection by parasite*

(B cells / plasma cells) secrete antibody ; **A** immunoglobulin / I<sub>g</sub>  
secondary response (qualified) / higher levels of antibody / rapid production of antibody ;  
ref. to antigen-antibody specificity ;  
antibody attaches to, surface protein / antigen, on parasite ;  
prevents attachment to red blood cell ; **A** prevents entry into red blood cell [4 max]

- (ii) genetic complexity of *Plasmodium* ; **A** ref to *Plasmodium*, being eukaryotic / having many genes

many antigens ;  
many stages in life cycle (within human) ;  
antigens change / antigenic variation, in different stages ;  
*Plasmodium* / parasite, lives within cells ; **A** antigenic concealment  
**A** only briefly free in the blood stream  
antibodies cannot work against stages within cells ; [2 max]

- (c) *use only one mark scheme as appropriate*

*drug is either*

competitive inhibitor / effect described in terms of competition ;  
drug molecule has, same / similar / shape, as, substrate / surface protein ;  
**A** complementary shape to active site  
**R** same / similar, structure, as substrate  
drug molecule fits into active site ;  
blocks access to active site / prevents formation of ES complex ;

*or*

non-competitive inhibitor / described in terms of not competing ;  
drug molecule fits into, another site (not the active site) / allosteric site ;  
active site changes shape so cannot accept, substrate / surface protein ;  
permanent (irreversible) / reversible ;

*or*

combines permanently with active site ;  
e.g. by covalent bonding ;  
blocks access to active site / prevents formation of ES complex ;  
increasing, substrate / surface protein, has no effect ; [3 max]

**[Total: 12]**

Q4.

- 1 (a) (i) (*nuclear envelope*) drawn with two membranes and a space and at least one nuclear pore ;  
(*mitochondrion*) two membranes with at least one crista attached or unattached ;  
mitochondrion drawn smaller than nucleus ; ora  
  
*if wrongly labelled or both labels omitted, penalise once* [3]
- (ii) (to nearest whole number) (x) 2857 ;; **A** 2829 – 2886  
  
*allow one mark for correct working if answer incorrect / not to whole number / no answer*  
length of scale bar in mm × 1000, divided by actual size  
e.g. 100 mm × 1000 / 35 (*scale bar 99–101 mm*) [2]
- (b) cell / plasma / cell surface, membrane(s) ; **R** membranes  
cytoplasm / cytosol ;  
ribosomes / 70S ribosomes / 18nm ribosomes ; **R** 80S / 20nm / larger, ribosomes  
DNA / genes ; **A** chromosome [3 max]
- (c) (infected person) coughs / sneezes / spits / releases sputum / breathes out / exhales ;  
**A** releases mucus **R** talks  
aerosol / droplets / moist air, inhaled / breathed in (by uninfected person) ; [2]
- (d) (i) 0.25 ; [1]
- (ii) *suggested reasons for high fatality ratios*  
  
poor / dense / overcrowded, housing / accommodation ;  
low protein diets linked to lowered immunity ;  
not, diagnosed / treated, early enough ;  
DOTS / described, not used ;  
lack of vaccination / vaccinations ineffective ;  
antibacterial drugs / antibiotics / AW, not available / too expensive ;  
medical services not available, qualified e.g. in rural areas / AW ;  
idea of TB, linked to HIV/AIDS / opportunistic disease ;  
MDR – TB / XDR – TB / not completing the course of antibiotic treatment increases  
resistance ;  
no effective antibiotics to use ;  
no facilities for isolating people ;  
lack of, testing / treatment of, cattle / milk ; **A** unpasteurised milk  
difficulty in obtaining reliable data / AW ;  
*ignore references to, overcrowded / poor, countries* [4 max]
- [Total: 15]

Q5.

1 (a) (i) Golgi body

at least three unlinked cisternae drawn in cytoplasm ;  
secretory vesicles forming at the side of the Golgi ;

*exocytosis*

vesicle shown fused to cell surface membrane ; **R** if add arrows pointing towards cell contents [3]

(ii) (to nearest whole micrometre) 5( $\mu$ m) ;

*allow one mark for correct working if answer is incorrect / not to whole number / no answer*

length of bar / 8000

e.g.  $\frac{4 \text{ cm}}{8000}$     $\frac{40 \text{ mm}}{8000}$     $\frac{40000 \mu\text{m}}{8000}$    **A** +/- 1mm on length of bar [2]

(b) capsule / slime layer ;

cell wall ; **R** cellulose / chitin, cell wall

flagellum (of flagellin) ;

DNA free in cytoplasm / loop of DNA / circular DNA / nucleoid / plasmid ;

DNA, naked / without histones ;

only, smaller / 70S / 18nm, ribosomes ; **A** only one type of ribosome

mesosome ;

[3 max]

(c) 0.47 ;

[1]

(d) *provide, boiled water / bottled water / sterile water ; A valid description of method to, remove / kill, bacteria*

*provide, oral / intravenous, rehydration therapy / ORT ; A ORS*

*(contains) glucose and, salts / electrolytes ;*

*absorption of salts helps to absorb glucose ;*

*(absorption of salts) increases water uptake, by osmosis / AW ;*

*deaths usually caused by (rapid) dehydration ;*

*idea of rapid provision (of, ORT / medical supplies / personnel) ;*

*provide antibiotics (for severe cases) ;*

*safe sewage disposal, qualified ; R sewage treatment plants*

[4 max]

(e) transmission cycle is broken ;

sewage treatment plants / mains drainage ;

human faeces do not come into contact with drinking water supply ;

water treatment plants ; **A** drinking water is, chlorinated / treated, to kill bacteria ;

drinking water is piped to homes ;

[2 max]

[Total: 15]

Q6.

- 4 (a) caused by pathogen, transmissible / communicable / contagious / transferable / passed from one person to another ;  
A for pathogen – microorganism / any two named types of microbe  
R parasite unqualified [11]

- (b) R virus or bacteria once in the answer  
female, *Anopheles* (mosquito) ;  
takes blood (meal) from an (infected) person, feeds on an (uninfected) person ;  
R 'bite' unless qualified with blood  
*Plasmodium* / parasite, transmitted in (mosquito's) saliva ;  
*Plasmodium* / parasite, blood transfusion / shared needles / across placenta / at birth ; [2 max]

- (c) max 3 for malaria max 3 if pathogen(s) is virus or bacterium

- 1 *Anopheles* / mosquito / vector, survives / breeds / lives, within the tropics / in hot and humid areas ; ora
- 2 *Plasmodium* / pathogen / parasite, needs to reproduce within the mosquito (at temperatures above 20°C) ;
- 3 eradicated in some countries outside the tropics ;
- 4 ref. to LEDCs and, poor / non-existent, mosquito control programmes ;
- 5 mosquitoes resistant to, DDT / insecticides / pesticides ;
- 6 *Plasmodium* resistant to, drugs / chloroquine / other named drug ;
- 7 TB is transmitted, by, droplets / coughing / sneezing ; A in the air
- 8 no vector / no mosquito / no requirement for hot or humid conditions ;
- 9 ref. to, HIV infection / lower immunity / immunocompromised ; [4 max]

- (d)
- 1 active immunity ;
  - 2 vaccine contains, antigen(s) / pathogen / microorganism / named type ;
  - 3 (primary) immune response ;
  - 4 B lymphocytes / B cells / plasma cells, synthesise / produce / secrete / release, antibodies ;
  - 5 ref. to T helper cells (enhancing humoral response) ;
  - 6 clonal selection / described ;
  - 7 specific, (T / B) lymphocytes / antibodies ; A 'particular' / AW
  - 8 memory cells, remain (in circulation) / give long-term immunity / give immunological memory / AW ;
  - 9 fast(er) second(ary) response ;
  - 10 ref. to boosters / AW ;
  - 11 immunised person cannot spread disease to others ;
  - 12 herd immunity / unimmunised people are safe(r) ;
  - 13 surveillance of population for signs of disease / when there is an outbreak ;
  - 14 ref. to ring immunity / AW ; [5 max]

[Total: 12]

Q7.

3 (a) 53 % ;; 2 marks for correct answer

max 1 mark for correct calculation but, no/incorrect, answer  
or not to nearest whole number

$$72.4 - 33.9 = 38.5$$
$$(38.5 / 72.4) \times 100 = 53.18 / 53.2$$

[2]

(b) R greater wealth unless linked to points below  
any two valid reasons e.g. accept answers written as ora

- 1 more educated population ; *in context of health*
- 2 better/greater access to, health care/AW ;
- 3 higher level of preventive medicine ; e.g. immunisation programmes
- 4 better diet ; A ref. to less malnourished  
A ref. to access to food supplies
- 5 greater access to, therapeutic medicines/drugs ; A antibiotics
- 6 better/less overcrowded, housing/living conditions ;
- 7 better, sanitation/sewage treatment ;
- 8 greater access to uncontaminated drinking water ;  
R clean water unqualified
- 9 fewer, fatal diseases/AW ;
- 10 ref. to effects of, civil war/war ;
- 11 ref. to natural disaster ;

[2 max]

(c) (i) rank of % positive (of countries) is different to rank of difference in decrease in life expectancy ;  
data quote to support ; e.g. Kenya 6th highest % positive but 3rd highest decrease in life expectancy

S. Africa 4th highest % positive but 6th highest decrease in life expectancy  
countries with, similar/same, decrease (in life expectancy) have different % positive ;  
data quote to support ; e.g.

Malawi 17.8 years decrease, 16%, cf South Africa 17.5 years, 19.9%  
Kenya 20.1 years, 14%, cf Zambia 20.1 years, 20% ;

*with ref. to decrease in life expectancy and % positive*

Kenya, does not fit general trend/AW ;  
South Africa, does not fit general trend/AW ;  
data quote to support ; e.g.

Kenya larger decrease than, Malawi/South Africa, but lower % positive  
Kenya 20.1 years decrease but only 14.0 %, compared to, Malawi 17.8 with 16.0%/  
South Africa 17.5 with 19.9 % ;

[2 max]

(ii) any two relevant factors e.g.

- 1 anti HIV drug therapy/AW ;
- 2 ref. to treatment of AIDS-related diseases ;
- 3 ref. to education to prevent, transmission/spread ;
- 4 use/provide free, condoms/femidoms ; A dental dams
- 5 avoid promiscuity ; A one sexual partner
- 6 HIV mothers avoid breast feeding ;
- 7 heat treat/screen, blood (for transfusion) ;
- 8 needle-exchange schemes/AW ; A ref. to sterile syringes
- 9 use of sterile equipment, qualified e.g. in surgery/tattooing/piercing ;
- 10 testing for HIV status/contact tracing ;
- 11 ref. to vaccine development ;

[2 max]

(d) 1 primary/immune, response ;

- 2 ref. specificity; in correct context
- 3 (HIV/virus) antigens ;
- 4 antigen presentation/antigen presenting cell/APC/described ;
- 5 clonal selection/described ; e.g. recognition of/binding to, antigen by, B-lymphocyte
- 6 sensitisation/activation/described ; e.g. cell growth or cellular changes
- 7 clonal proliferation/formation of clone/mitosis/cell division/AW ;
- 8 B-lymphocytes/B-cells/plasma cells, synthesise/produce/secrete/release, antibody ;
- 9 T(helper)-lymphocyte response described ; e.g. cytokine production
- ignore ref. to T killer cells

[5 max]

[Total: 13]

Q8.

4 (a) any one correct description (1 mark) with explanation (1 mark) e.g.

any named biological control method e.g. *B. thuringiensis* ;  
kills mosquito larvae ;

use of insecticides ;  
kills (adult) mosquitoes ;

elimination of standing water ;  
removes, mosquito breeding sites/egg-laying areas ;

use of oil on water ;  
prevents maturation of/kills, mosquito larvae ;

[2 max]

- (b) (malarial) parasite/pathogen/*Plasmodium*, has many antigens ;  
eukaryotic/many genes ;  
many different stages of life cycle ;  
ref. to more than one *Plasmodium* species/strain of each species ;  
mutation changes antigens (over time)/antigenic shift/antigenic drift ;  
parasite only vulnerable, at certain stages of life cycle/when free in plasma ;  
antigenic concealment/described ;  
AVP ; e.g. changes antigens which are expressed (through gene switching)

[3 max]

(c) percentage of, parasites killed/growth inhibition, increases with drug concentration for both parasites ;  
effect is greater on chloroquine-resistant parasites/AW ;  
chloroquine-sensitive parasites not affected until  $1 \mu\text{mol dm}^{-3}$  ;  
further use of data from Fig. 4.1 to illustrate ;  
further detail of difference in trend(s) ; **A** descriptive or figures [3 max]

(d) (i) (percentage) increase in malaria is high(er) in, countries in the, south/south and east ;  
ora **A** named countries **R** more malaria

ref. (percentage) increase correlates with countries where HIV incidence is higher ;  
*penalise once if no ref to increase*

data quote ; [2 max]

(ii) HIV, infects/AW, T (helper)–lymphocytes/T-cells ;  
qualified ref. to immune system ;  
(HIV and) malaria may be contracted via blood transfusion ;  
ref. to reduced number of workers so malaria prevention not carried out ; [2 max]

[Total: 12]

## Q9.

6 (a) *assume answer refers to active immunity unless told otherwise  
accept ora if answer focuses on passive immunity*

immune response ; **A** 'immune system responds'  
to antigen ;  
clonal selection occurs / ref to B cells or T cells activated ;  
antibodies made ; **A** ora for passive  
memory cells produced ;  
long-lived / long-term effect / permanent ;  
not immediate / slow ; one week minimum

*passive only* – antibodies removed from circulation ; [max 3]

(b) *no mark for passive immunity as in the question*

antibodies from, mother / colostrum / across placenta ; **R** 'immunity from mother'  
interact with, antigen / measles antigens / virus / pathogen ;  
(so) prevents an (active) immune response ; **A** no immune response

too early for immune response to occur / T cells or B cells not mature ;  
**A** not immunocompetent / immune system not developed [max 2]



- (c) *idea that*  
 all countries with >90% of districts reporting 90% of children vaccinated have very low death rates (for children under 5 years of age) ;  
 ref to any percentage(s) <90% with wide variation in death rates ;  
 data quote, giving % and death rate(s) ; e.g. 95%, less than 50 deaths per 1000  
 herd immunity / described , decreases transmission ;  
 A description of transmission e.g. 'spread'

[max 2]

[Total: 7]

Q10.

- 4 (a) *Mycobacterium, tuberculosis / bovis* ; 1

- (b) (i) 2 marks for correct answer  
 x 30 000 ;;  
 (image length = 60 mm) 60 000 $\mu$ m / 2 $\mu$ m A 59 / 61 mm (29 500 / 30 500)  
 1 mark if incorrect answer e.g. not converted correctly, but measurement and method correct [2]

- (ii) any 3 relevant e.g.  
 DNA not surrounded by, nuclear, envelope / membrane ; AW  
 A no (true) nucleus  
 circular DNA ; A loop  
 DNA not complexed with histone proteins ; A naked DNA  
 (only) 70S / smaller / 18nm, ribosomes ; A ribosomes not attached to membranes  
 no double membrane-bound organelles; A no, mitochondria / chloroplasts  
 absence of named organelle ; e.g. Golgi apparatus, ER / RER / SER  
 if previous mp not given, A no membrane-bound organelles  
 capsule / slime layer ;  
 very small diameter / 0.5 to 5.0 $\mu$ m ;  
 cell wall of, murein / peptidoglycan ;  
 examples of other relevant points  
 pili / pilus ;  
 no 9+2 microtubule arrangement ;  
 flagellum not covered by cell surface membrane ;  
 presence of plasmids ; [max 3]

(c) (i) *any 1 relevant e.g.*  
 ref. (BCG) vaccine / vaccination programme ;  
 improvements in housing conditions / less overcrowding (housing) / better ventilated homes ; **R** better standards of living *unqualified*  
 earlier detection / mass, chest X-ray / screening ; *i.e. in preventing spread*  
 improvements in diet (leading to better immune system) / AW ;  
 improved awareness of, transmission / AW ; **R** better education unqualified  
 contact tracing / explained ;  
 ref. testing / treating, cattle / milk ; [max 1]

(ii) *any 3 relevant e.g.*  
 development of antibiotic resistance (by organism) ; **A** drug resistance  
**R** immunity  
 ref. impact of HIV infection ;  
 higher rate of immigration from countries with high incidence / AW ;  
 increase in tourism to countries with high incidence ;  
 reduced surveillance leading to undetected cases (and hence spread) ;  
 (detected cases, MDR) unwillingness / AW, to maintain drug regimen / AW ;  
 ref. to vaccination programmes no longer taking place ;  
 ref. to poor / overcrowded, housing (in cities) / AW ; *must be in context of developed countries* [max 3]

(d) (i) binding of tRNA prevented ;  
 (so) no anticodon-codon binding ;  
 peptide bond formation prevented ;  
 mRNA attachment prevented ;  
 inhibition of enzymes involved in translation ;  
 ribosome movement along mRNA, hindered / prevented ;  
 inhibits association of large and small subunits / AW ; [max 2]

(ii) *mammalian cell*  
 cell surface membrane impermeable ;  
 degraded, before entry into / within, the cell ;  
 broken down by enzymes ;  
 eukaryotic / 80S (22nm) / larger / different, ribosomes / ribosome structure ; [max 1]

[Total: 13]

Q11.

(d) 1 do not prescribe for viral diseases ;  
 2 only use when necessary / do not overprescribe ;  
 3 only available on prescription / not available 'over the counter' ;  
 4 people must, complete the course / take as instructed ;  
**R** take a long course  
 5 test to find out which is most appropriate antibiotic to use ;  
**A** use most, appropriate / effective, antibiotics  
**A** use narrow-spectrum antibiotics  
 6 details of sensitivity test ;  
 7 rotate / AW, antibiotics / use in combination ; **R** use many antibiotics  
 8 do not use same antibiotics for humans and animals ; [max 2]

Q12.

5 (a) *Vibrio cholerae* ;

[1]

(b) 1 binding / AW, to, active site / site other than active site / allosteric site ;

2 further detail / consequence of, binding ;

*if binds to active site*

complementary shape to active site

similar shape to substrate **A** same shape **A** similar structure

competes with substrate for active site

*if binds to other site*

changes shape of active site

shape of substrate no longer complementary to active site

enzyme-substrate / ES, complex (already in active site)

cannot make product

*for both types of binding*

3 substrate unable, to enter / bind to, active site ;

**A** fewer / no, enzyme-substrate / ES, complexes form

4 AVP ; e.g.

ref. to decreased enzyme activity, qualified e.g. less ATP produced /

lower respiration rate

preference for, permanent / irreversible, inhibitor (to maximise effect)

correct ref. to concentration of inhibitor and effect

[max 3]

(c) (i) 2.70 / 2.71 ;;

*1 mark if answer incorrect but correct calculation*

*5 143 / 190 130*

[2]

(ii) *max 3 if no reference to particular regions*

*for differences in cases*

*accept ora for mark points*

1 idea of overall greater exposure to contaminated, water / food ;

2 no, safe (drinking) water sources / bottled water / water treatment plants ;

3 lack of hygiene, qualified ; e.g. hands not washed after defaecation

4 faeces / sewage, mixing with drinking water / onto crops; **A** poor sanitation

5 insufficient / poor access to, (oral cholera) vaccines ;

6 vaccine less effective in some areas ;

7 lack of education about the way cholera is transmitted ;

8 differences in effectiveness of surveillance and reporting ;

9 qualified ref. to, natural disasters / wars / refugee camps ;

*for differences in fatality rates*

10 increase in, antibiotic / drug, resistant strains (in some areas) ;

11 lack of, health services / drugs / antibiotics / ORT / skilled personnel ;

**A** lack of medicines

12 AVP ;

[max 4]

[Total: 10]

Q13.

- 3 (a) (i) quaternary (structure) ; [1]
- (ii) alpha /  $\alpha$ , helix ; [1]
- (b) (i) facilitated diffusion ; [1]
- (ii) osmosis ;  
 increasing, ion / solute, concentration in lumen (of intestine) lowers water potential ; ora  
 water follows, from a high(er) to a low(er) water potential / down a water potential  
 gradient; [3]
- (c) (i) *must have ref. to organism at least once to gain max*  
 bacteria / pathogen / *V. cholerae*, in faeces (of infected person) / in sewage containing  
 faeces (from infected people) ; AW  
 bacteria / pathogen / *V. cholerae*, ingested / taken in orally (by uninfected person), in  
 (contaminated) food / water ;  
 A faecal – oral route for one mark if previous two mps not given [2]
- (ii) general ref. to problems associated with increased numbers of people and lack of  
 infrastructure ;  
 examples ;;  
 e.g. problem providing, safe / uncontaminated, drinking water ;  
 faeces / sewage, mixing with drinking water ; A no / poor, sanitation  
 unable to practise good hygiene ; A example e.g. hands not washed after defaecation  
 infected people sharing latrines with uninfected / AW ;  
 lack of, medical care / treatment, leading to larger pool of infected people (at any one  
 time)  
 lack of, health services / drugs / antibiotics / ORT / skilled personnel  
 unable to supply sufficient vaccines  
 lack of food / poor diet, so vaccines less effective
- credit relevant examples linked to a particular type of disaster* [max 2]

**[Total: 10]**

Q14.

- 5 (a) 1 ref. vaccines contain antigens ;  
 2 antigens are (mostly), proteins / glycoproteins ;  
 3 antigens, denatured by heat / not denatured by radioactivity ; **A** proteins denatured *in context of antigenic proteins*  
**R** parasite is denatured  
 4 detail e.g. loss of tertiary structure / bonds break ;  
 5 shape to be maintained for specificity of immune response / AW ;  
 6 AVP ; e.g. ref. to production of memory cells (for immunity) [max 3]

- (b) 1 first form of, pathogen / parasite, free / exposed, in plasma ;  
**A** not inside cells  
 2 second form of, pathogen / parasite, concealed / hidden, in liver / red blood cells ;  
*for either mp 2 or 3*  
 3 ref. to degree of exposure to antibodies / lymphocytes  
*idea that*  
 4 fewest number of parasites to destroy / earlier defence always more effective ;  
 5 vaccination against form leaving liver would, not protect against liver invasion / still cause liver damage ;  
 6 AVP ; e.g. suggestion that first form of parasite is easier to harvest [max 3]

- (c) 1 primary (immune) response / artificial active response ;  
 2 antigen presentation / described ;  
 3 clonal selection / described ; e.g. **A** specificity to malarial antigen  
 4 clonal proliferation / B-lymphocyte division by mitosis / AW ; **A** B cell  
 5 detail of changes occurring from B-lymphocyte to plasma cell ;  
 6 B-lymphocytes / B cells / plasma cells, produce antibody ;  
 7 correct ref to role of  $T_h$  cells in context ; [max 5]

**[Total: 11]**

Q15.

- (b) 1 zidovudine , competitive inhibitor and efavirenz , non-competitive ;  
 2 zidovudine, complementary to active site ;  
 3 efavirenz, binds to allosteric site/ reference to allostery ;  
 4 efavirenz changes the, shape/ structure, of the active site ;  
 A denatures/ changes tertiary structure so substrate will not fit  
 R changes shape unqualified  
 5 *either*  
 the effect of zidovudine is, reduced/ reversed, by increasing the substrate concentration  
 or  
 the effect of efavirenz is not, reduced/ reversed, by increasing the substrate concentration ; [max 4]
- (c) 1 virus may be resistant to one or more of the drugs/ very low chances that HIV is resistant to all of the drugs ;  
 R virus immune  
 2 (resistance due to) change to, active site/allosteric site/tertiary structure, of enzyme ;  
 A drug can no longer fit into active site  
 3 some drugs may be more effective than others/ AW ;  
 4 reduces risk of drug resistance developing ;  
 5 HIV, has a high mutation rate/ changes surface proteins / changes antigens ;  
 A antigen(ic), shift/ drift  
 6 person may have mixture of strains of HIV ;  
 7 *idea that* virus will be at different stages in its, life/replication, cycle ;  
 8 AVP ;  
 e.g. more than one competitive to reduce chances of, ES complexes/ AW  
 drugs work better in combination/ synergy idea  
 drugs inhibiting two different enzymes, so more effective [max 2]
- (d) 1 antibiotics are not effective against HIV or viruses/ antibiotics are effective against, (named) bacteria/ bacterial disease ;  
 A fungi/ protoctists/ protists/ malaria  
 R antibiotics prevent infection  
 2 *idea that* viruses have no, sites/ targets, where antibiotics can work ;  
 3 viruses have no, cell walls/ ribosomes/ cell membranes ;  
 A have different enzymes  
 4 viruses are within cells, *idea that* antibiotics cannot reach them ;  
 5 people with HIV are more susceptible to bacterial infections/ reference to immune suppression/ weak immune system ; [max 2]

Q16.

- 3 (a) 1 caused by, a pathogen ;
- 2 transmissible / communicable ; **A** passed from, person / animal, to person  
*ignore* contagious
- in context of tuberculosis*
- 3 (pathogen is) a bacterium / *Mycobacterium (tuberculosis / bovis) / M. tuberculosis / M. bovis* ;
- 4 mode of transmission detail ; *one from*  
aerosol / droplet, infection / transmission  
in droplets, from (infected) person, exhaling / AW *if both of these*  
/ coughing / sneezing / talking in droplets, / inhaled / *given this is also*  
AW, by (uninfected) person *mp 2* }  
person, drinks (unpasteurized) milk / eats meat, from infected cattle
- A** contaminated, milk / meat [max 3]
- (b) 1 kill bacteria / bactericidal ; **A** cause bacteria to, lyse / burst **A** destroy
- 2 (or) bacteriostatic / prevents bacterial growth / prevents bacterial replication;  
**A** ref. to preventing protein synthesis / inhibiting metabolic reactions
- 3 ref. to preventing spread (of bacteria) within body ; **A** prevents reservoir for re-infection
- 4 do not affect, human cells / human tissue / not toxic (to humans) ;
- 5 prevents death / consequences may be fatal if no antibiotic treatment / AW ;  
**A** ref. to, alleviating symptoms / faster recovery  
**A** restores good health / person feels well again / person cured
- 6 ref. to role in preventing, transmission / spread, of disease ; *do not confuse with mp 3*

- 7 ref. to (antibiotic) treatment of TB ; e.g.  
*one of* isoniazid, rifampicin (rifampin), pyrazinamide, ethambutol, streptomycin  
*one of* 6–12 months (latent), longer for active disease, two years or more for drug-resistant forms  
 need combination treatment if active disease  
 ref. to, MDR-TB / multidrug-resistant TB or XDR-TB / extensively drug-resistant TB

- 8 part of DOTS regimen / described ;  
 (*directly observed therapy short-course / direct observation treatment short course*)  
 [max 4]

- (c) 1 statistical, correlation / link / association, between smoking and TB ; AW  
 A another valid suggestion in addition to mps 2-6 suggesting link
- 2 where TB, cases / death rates, are high tobacco smoking is also high ;
- 3 in areas where there is, no overcrowding / AW, smokers have higher number of TB cases ;
- 4 (ref. projects) death rates from TB reduced where patients stop smoking ;
- 5 higher cases TB in work places where smoking occurs ;
- 6 higher cases of TB in children living with parents who smoke ; [max 2]

- (d) 1 lack of / paralysed / AW, cilia, so mucus, not wafted away / accumulates ;

R dead cilia

- 2 pathogen / bacteria / *Mycobacterium*, remains in lungs / accumulates ;
- 3 ref. to increased opportunity / AW, for bacteria to, enter cells / infect ;
- 4 nutrients provided by excess mucus encourage growth ; AW
- 5 smoking weakens the immune system ;
- 6 detail ; e.g. fewer / less active / AW, phagocytes / macrophages [max 3]

- (e) coronary bypass (surgery) / coronary artery bypass (graft) ;

A bypass, surgery / graft / operation

R heart bypass

heart transplant ;

angioplasty ;

stent (insertion / AW) ;

[max 2]

[Total: 14]

Q17.



- 6 (a) causes (mainly) linked to habits during life of person /AW ;  
 result of choices made by person /AW ;  
 example ;  
 e.g. (tobacco) smoking / exposure to asbestos at work [max 2]
- (b) *pathogen* = virus ;  
**ignore** Morbilli / measles  
*transmission*: aerosol, infection / transmission or droplet, infection / transmission ;  
**A** aerosol route described from infected to uninfected  
**ignore** contact [2]
- (c) (infected), visitors / immigrants / returning residents, from countries where measles occurs ;  
 unvaccinated people returning from travel abroad ;  
 reduction in vaccination rates ;  
 percentage cover too low ;  
 change in reporting pattern ;  
 existing vaccine no longer, effective / AW ;  
 AVP ;  
 e.g. mutation of virus produces new antigens, vaccines ineffective  
 increase in malnourished children, no immune response to vaccine [max 1]
- [Total: 5]**

18.

- 5 (a) female, *Anopheles*, mosquito sucks blood from (infected)  
 person; R. bites  
 parasites / plasmodia / pathogens reproduce / multiply / form  
 gametes (in mosquito);  
 injects / inserts / pumps in / (saliva) with parasites / transmits /  
 transfers parasite as feeds / in saliva (into uninfected  
 person); **2 max**
- (b) *malarial parasite* has  
 nucleus / nuclear membrane / nuclear envelope;  
 mitochondria;  
 membranous organelles; R. ribosomes R. nucleolus **2 max**
- (c) fewer red blood cells / number of r.b.cs. reduced;  
 due to bursting / rupturing of r.b.c. / parasite destroys r.b.cs.;  
 less haemoglobin;  
 less oxygen transported / reduced ability to carry oxygen;  
 waste excreted / toxins released (by parasite);  
 symptom; A. one from - anaemia / fatigue / tiredness / muscular  
 pain / headaches / nausea / fever / high temp. and sweating /  
 inability to control temp. / shivering **3 max**

**[Total: 7]**

Q19.

Question	Expected Answers	Marks
3	<i>Vibrio cholerae</i> / <i>V. cholerae</i> ; (correct spelling required) ignore upper case / lower case diarrhoea (phonetic spelling req); A. vomiting / 'rice water' only R. loss of fluid / loss of water and salts (contaminated) <u>food / water</u> ; R. drinks R. cooking utensils <u>immune response</u> ; <u>antibodies / immunoglobulins</u> ;	[Total 5]

Q20.

- 4 (a) Q - cell wall; R cellulose cell wall  
R - flagellum; A flagella  
S - (loop/circular) DNA; A nucleoid  
R plasmid R chromosome 3
- (b) nucleus/nuclear membrane/nuclear envelope/linear DNA/chromosome/  
nucleolus;  
mitochondrion; A mitochondria  
lysosome(s);  
endoplasmic reticulum/fixed/larger/80S, ribosomes;  
Golgi (apparatus/body);  
centriole(s);  
R membrane based organelles 3 max
- (c) (i) Mycobacterium;  
(A M. tuberculosis/M. bovis) 1
- (ii) (infected) person, sneezes/coughs/sputum/spitting/breathes out;  
aerosol/droplets, in the air/moist air, inhaled/breathed in by (uninfected person); 2

(d) bacteria enter cells in lungs/hidden from immune system;

antibiotics kill/destroy/reduce growth/AW, of bacteria;

> 1 antibiotic used, to combat/avoid development of resistance;

makes sure that all bacteria are killed;

prevents leaving a reservoir of infection/AW;

**3 max**

**[Total 12]**

**Q21.**

**3 (a) (i)** 2 marks for the correct answer – leeway on measurement to be decided.

10 mm ;  
100 000

100 nm.

**[2]**

(ii) Good/high, resolution. A short wavelength

**[1]**

(b) (T lymphocyte) makes viral, protein/enzyme;  
Cell needs more enzymes for replicating, DNA/protein synthesis/AW;  
AVP.

**max [1]**

(c) Sexual intercourse;  
Infected, blood/blood products;  
Sharing/re-using, hypodermic needles;  
Across placenta/from mother to foetus;  
Breast milk;  
AVP.

**max [3]**

(d) No cure/no vaccine;  
Drugs are expensive.

*Problems with*

Symptomless carriers (spreading the virus);

Testing people for HIV status;

Providing, condoms/femidoms;

Educating about risks;

Tracing contacts (of infected people);

Screening blood donations;

Treating blood to kill HIV;

AVP.

**max [3]**

**[Total: 10]**

**Q22.**

- 5 (a) (i) *Mycobacterium, tuberculosis / bovis* ;  
**A** *M. tuberculosis / M. bovis* [1]
- (ii) (infected person) coughs / sneezes / spitting / sputum / breathes out ;  
aerosol / droplets / moist air, inhaled / breathed in by (uninfected) person ; [2]
- (b) make fair / valid comparison ; **A** easier to, compare /  
interpret total populations of regions are different ;  
calculate, incidence / prevalence (rates) ;  
so can see where impact (of TB) is greatest ; [2 max]
- (c) disease of, poverty / the poor ;  
people, living / sleeping, in close proximity / overcrowded conditions ;  
HIV / AIDS / malnutrition, weakens immune system / AW ;  
TB is opportunistic disease / described ; e.g. easily infects / increased susceptibility to TB  
HIV infection rates are highest in, Africa / S-E Asia ;  
  
control regimes / vaccination programmes for TB are better in, some countries /  
regions, than others ; ora  
ref to (WHO) DOTS scheme ;  
ref to availability / combination of / length of treatment / resistance, re antibiotics / drugs ;  
  
use of comparative data to support a statement ;  
**A** either quote figures or calculation, e.g. percentage  
  
AVP ; e.g. general ref to provision of health services  
ref to HIV and, T cells / lymphocytes  
ref to, cost / complexity, of providing treatments  
ref to lack of, knowledge / education [3 max]
- (d) vaccine (BCG) is not effective ;  
does not always give lasting protection / effectiveness decreases with years unless exposure  
to TB ;  
no worldwide vaccination programme (as there was for smallpox) ;  
endemic all over the world ;  
many, carriers / symptomless people ;  
bacteria remain in the body for a long time ;  
intracellular parasite / lives in lung cells ;  
AVP ; e.g. lack of protein in diet means it is difficult to produce antibodies /  
difficult to produce herd immunity / some ref to antigenic variation / bacteria can live in animals  
[3 max]

Q23.

- 5 (a) transmitted by, *Anopheles* / mosquito / (insect) vector ;  
*P. falciparum* / parasite, needs, warm / hot, temperatures / >20°C,  
to complete its life cycle (in the mosquito) ;  
requirement for areas of still water (ref. mosquito life cycle);  
eradicated in areas outside tropics (e.g. North America) ; [2 max]
- (b) (i) A 28 ;  
B 14 ; [2]
- (ii) reduce / halve, chromosome number ;  
retain diploid number at fertilisation ;  
prevent chromosome number doubling each generation ;  
ref to variation ; A ref. to meiosis crossing over / independent assortment [2]
- (c) genetic complexity of *Plasmodium* ;  
A ref to *Plasmodium*, being eukaryotic / having many genes  
many antigens / antigenic variation ;  
many stages in life cycle (within human) ;  
antigens change in different stages ;  
idea that variation generated during meiosis ;  
mutations / recessive alleles, are expressed in haploid stage(s) ; ora  
*Plasmodium* / parasite, lives within cells ; A only briefly free in the blood stream  
A antigenic concealment  
T-lymphocyte / B-lymphocyte, receptors not stimulated ;  
antibodies cannot work against stages within cells ; [4 max]
- [Total: 10]

#### Q24.

- 5 (a) meiosis in lowest box ;  
mitosis in the other two boxes ; [2]
- (b) larger / 80S, ribosomes ;  
mitochondria ;  
Golgi (body / apparatus) ;  
(smooth / rough) endoplasmic reticulum ; A (smooth / rough) ER  
vacuole(s) / vesicle(s) / lysosomes ;  
centriole / centrosome ;  
A membrane-bound organelles if no examples given  
R chloroplast/ chromosomes / nucleus [2 max]
- (c) ignore any other methods of transmission given  
(spores) in droplets / moist air, coughed / sneezed / breathed, out ; A aerosol  
breathed in (by other person) ; [2 max]

- (d) 1 no (effective) vaccine ;  
 2 HIV has a high mutation rate ;  
 3 antigens change / different antigens / different strains ;  
 4 no cure ;  
 5 drugs, are expensive / not widely available / not effective / AW ;  
 6 vertical transmission / mother to child ;  
*problems with:*  
 7 symptomless carriers (spreading the virus) ;  
 8 testing people for HIV status ;  
 9 providing, condoms / femidoms ;  
 10 promiscuity ;  
 11 educating about risks / AW ;  
 12 reuse of needles ;  
 13 tracing contacts (of infected people) ;  
 14 testing / screening, blood donations ;  
 15 treating, blood / blood products, to, destroy / inactive / 'kill', HIV ;  
 16 ref to cultural issues ; *accept relevant examples*  
 17 ref to poverty ;  
 18 AVP ; e.g. war / civil disturbance, out of date drugs, ref to transport links  
*ignore resistance of HIV* [4 max]
- [Total: 10]**

**Q25.**

- 4 (a) (i) *Vibrio cholerae* ; [1]
- (ii) active transport / described as movement against concentration gradient ;  
 A facilitated diffusion / described [1]
- (iii) (bacteria) leave infected person in faeces / AW ;  
 (bacteria) enter water supply / AW ; A idea of contaminated, food / utensils  
 (bacteria) ingested by uninfected person ; [3]
- (b) *must be in context of B-lymphocytes / B-cells / plasma cells*  
*max 3 if T-cells*
- secondary response A ora*  
 presence of memory cells / AW (giving larger numbers) ;  
 ref. increased chance of, encountering antigen / antigen presentation / clonal selection ;  
 ref. larger numbers cells following, clonal expansion / AW (cf primary response) ;  
 (so) shorter duration for onset of antibody production ;  
 (so) higher antibody concentration ;
- secondary response antibody production (by plasma cells) lasts longer ;  
 AVP ; e.g. faster rate, plasma cell / antibody, production, ref. longer-life of cells  
 involved in secondary response [max 4]

- (c) 1 poor sanitation / no treatment of faecal waste / AW ;  
 2 contamination of (drinking) water supply ;  
 3 poverty, qualified / poor living conditions  
 4 poor hygiene ;  
 5 poor / lack of, (health) education about transmission ;  
 6 ref to natural disasters ; e.g. assistance / aid / medical help / AW, cannot arrive in time  
 7 ref. refugees / displaced people ;  
 8 lack of, water purification equipment / bottled water / AW ;  
 9 no rehydration therapy available (at time when needed) ;  
 10 no (effective) vaccine ;  
 11 further detail ; (bacteria live in gut, where immune system is not effective)  
 12 AVP ; e.g. contamination of vegetable plots with faecal waste, ref. to different strains [max 4]

[Total: 13]

Q26.

- 2 (a) communicable / transmissible / contagious / transferable / AW ;  
 A passed from one (infected), host / organism / one person, to another  
 A 'passed on'  
 caused by, a pathogen / microorganism / *at least two* named types of pathogen ;  
 A virus, bacterium, fungus, protist, worm ;  
 R parasite unqualified by two types [max 2]
- (b) *Plasmodium, falciparum / ovale / vivax / malariae* ;  
 A phonetic spellings for specific name, A plasmodium  
 R if specific name first, [1]
- (c) (i) (only) female feeds on blood / male does not feed on blood ;  
 female requires blood (protein) for (development of) eggs ;  
 (only) female carries, pathogen / disease-causing organism / *Plasmodium* / parasite ;  
 A (only) female transmits the disease  
 (only) female is vector ; *ora ignore* female carries, the disease / malaria [max 1]
- (ii) anti-coagulant (in saliva) is passed when mosquito, sucks blood / feeds / bites / takes a blood meal ;  
 anti-coagulant prevents blood clotting when mosquito, sucks blood / feeds / bites / takes a blood meal ; [max 1]

---

(iii) *in marking accept*  
*Plasmodium* / pathogen / causative organism / malarial organism *where parasite is given below*

*short time (in blood plasma)*  
for exposure to cells of the immune system / AW ;

next stage(s) of life cycle inside cells ;  
A sporozoites into merozoites in liver /  
merozoites into schizonts in red blood cells

parasite gains, food / energy, from cells ;  
parasite, reproduces / multiplies, inside (liver / red blood) cells ;  
damage to / bursting of / lysis of / impaired function of, cells ;

(antimalarial) drugs cannot penetrate (liver / red blood) cells ;  
parasite, concealed / 'hides', from host immune system ;  
A antigen concealment ;

no symptoms, until parasite leaves cells / while parasite is in cells ;  
*idea that* people incubating disease are symptomless ;  
A symptomless carriers  
*idea that* treatment unlikely to prevent spread from infected person ;

AVP ; *examples*  
different stages provide problems with drug / vaccine development  
AVP ; mode of action of potential drugs – block attachment sites on cells  
parasite in blood cells allows testing by taking blood samples  
further development of any idea given above

[max 2]



- (d) if virus / bacterium / disease used instead mark to max 3  
in marking accept  
*Plasmodium* / pathogen / causative organism / malarial organism where parasite is given below

distribution described for one mark

either

(mainly in) tropics / between the tropics

or

any two named, areas and/or countries, affected ;

e.g. areas (sub-Saharan) Africa, Central America, South America, South Asia, Central Asia, Middle East, Caribbean

e.g. countries India, Sri Lanka, China, Vietnam, Cambodia, Brazil, Kenya

discussion to max four

- 1 (areas where) both parasite, and, vector / mosquito / *Anopheles*, are present ;
- 2 *Anopheles* / mosquito / vector, survives / breeds / lives, in, hot and humid areas / moist tropical areas ; **ora** A standing / stagnant, water
- 3 parasite, needs to reproduce within the mosquito (at temperatures above 20°C) ;
- 4 eradicated in some countries / any e.g. (USA, Italy) ;
- 5 ref to LEDCs and, poor / non-existent, control programmes ;  
A poor health facilities / poor drug supplies / AW
- 6 mosquitoes resistant to, DDT / insecticides / pesticides ;
- 7 parasite resistant to, chloroquine / drugs ;
- 8 link between human population density and *Anopheles* ;  
e.g. human activity provides (lots of) breeding sites for *Anopheles*
- 9 occurs where named high risk group(s) exist ;  
e.g. refugees, HIV-positive pregnant women (more likely to pass HIV to unborn children), (young) children
- 10 (outside tropics) disease spread by, travellers / tourists / migrants / refugees ;
- 11 AVP ;  
most cases / over 90% cases, in (sub-Saharan) Africa  
not, at high altitude / in deserts  
different species of *Plasmodium* differ in geographical distribution / AW  
misdiagnosis (so not reported)  
changing pattern linked to, global warming / changes in land use / deforestation / irrigation / other relevant named  
R references to sickle cell

[max 4]

[Total: 11]

Q27.

2 (a) *Mycobacterium tuberculosis* / *Mycobacterium bovis* ; (1)

(infected person) coughs / sneezes / spits / exhales / breathes out / aerosol (infection) / droplet (infection) / moist air (containing the pathogen) ;  
(uninfected person) inhales / breathes in / inspires ;  
*ignore ref. to cattle*  
*treat ref. to virus etc as neutral* (2)

[3]

- (b) 1 ref. patient does not complete course / takes inadequate dose / stops taking when feels better ;  
2 problems with continuing supply (of antibiotics) ;  
3 not all bacteria killed ;  
4 ref. mutation to become resistant ; R immune  
5 likelihood of resistance increases if only one antibiotic used ;  
6 ref. to changes in bacterium to enable resistance ;  
7 ref. to changes in host cell (membrane structure) ;  
8 AVP ; e.g. repeated exposure to different drug regimes (because of mp. 1)  
exposure to bacteria with different resistance

[max 2]

- (c) 1 ref. to, worldwide incidence of TB / TB found worldwide ; AW  
2 highest, incidence / AW, (sub-Saharan) Africa / LEDC / developing countries ;  
3 problem with, vaccine / BCG, qualified ; e.g. doesn't work well, everywhere / in Africa / in Far East  
doesn't work well for all ethnic groups  
less efficient with age  
ref. cold chain / needs to be kept cold  
knowing when enough people vaccinated  
ref. to cost  
R vaccine doesn't work  
4 difficult to identify infected people / ref. symptomless carriers / AW ;  
5 difficulty with, contact tracing / described ;  
6 difficult to diagnose / time to diagnose (can infect others) ;  
7 ref. to transmission from animals to humans ;  
8 weakened immune systems / link with HIV/AIDS / TB is opportunistic ;  
9 ref. social factor ; e.g. overcrowded living conditions, poor diet, remote areas  
10 coordination of, vaccine / treatment ;  
11 ref. to difficulty of administering, drugs / DOTS ;  
12 lack / availability, of trained personnel ;  
13 ref. to political problems ; e.g. war , unstable regimes, refugees, migration  
14 cost, qualified with additional relevant point ;  
15 AVP ; e.g. ref. to countries (e.g. Russia) with large area / low population density,  
16 AVP ;ref. to quarantine problems, travel qualified, other social factor

[max 5]

[Total: 10]

Q28.

- (b) (i) ill-health / absence of well-being / abnormal condition / AW, (affecting an organism);  
 reduced effectiveness of, functions / named function ; AW  
 (illness with a set of) symptoms ; AW **A** signs  
 poor / AW, physical, mental or social, well-being ; **A two out of the three**  
*absence of well-being for two of the three = 2 marks* [max 2]
- (ii) 1 stable virus / virus did not mutate (frequently) ;  
 2 same vaccine could be used all the time ;  
 3 cheap to produce / ease of production ;  
 4 used a, vaccinia / harmless, virus (so people could not get smallpox) ;  
 5 able to use a 'live' virus (for stronger immune response) ; **A** live vaccine  
 6 vaccine, thermostable / AW ; **A** no requirement for keeping in cold  
 7 vaccine easy to administer ; **A** no need for boosters [max 2]
- (iii) *cholera up to max 4*  
 1 transmission cycle is difficult to break; **A** described with example(s)  
 2 ref. difficulty in administering e.g. refugee camp, displaced, disaster ;  
 3 poor diet, lowered immune response ;  
 4 more than one strain (needs more than one type of vaccine) ; **A** more than one  
 type (that causes cholera) **R** constantly mutating  
 5 vaccine, only gives short-term protection / requiring boosters ;  
 6 antigenic concealment ;  
 7 qualified ; e.g. organism in intestines, difficult for antibodies to reach  
 8 ref. (older or newer oral) vaccine, not successful for everyone / variable (60–65% up  
 to 90% depending on population group) protection ;  
 9 no requirement by health authorities (for vaccine) / vaccine not used by health  
 authorities ; AW
- sickle cell*  
 1 no vaccine available ; **A** cannot vaccinate against sickle cell  
 2 not caused by pathogen / non-infectious / non-transmissible / non-communicable ;  
 3 genetic / inherited, disease / AW ; **A** caused by a mutation  
 4 affects all red blood cells so vaccine would lead to their destruction ; [max 5]

Q29.

- 4 (a) (i) (estimated) number of newly infected people**
- 1 increases (steeply) (from 1990) until 1996 / 1997 ;
  - 2 peaks at, 3.5 million / any figure between 3 and 4 million / 3 to 4 million ;
  - 3 (gradual) decrease from, 1996 / 1997 ;
  - 4 number of new cases in 2008 is greater than in 1990 ;
- [max 3]

- (ii) stated precaution(s) to reduce risk of infection by**
- 1 using, condoms / femidoms ;  
     **A safe(r) sex / use protection during sexual intercourse**
  - 2 abstinence / monogamy / less promiscuity ;
  - 3 not sharing needles / using sterile needles / needle exchange ; **A syringes**
  - 4 not breast feeding ;
  - 5 (heat) treated blood (products) / testing potential blood donors or donated blood ;
  - 6 ref to contact tracing ;
  - 7 increased awareness of, precautions / risks / transmission ;
  - 8 increased use of (antiviral) drugs reduces transmission ;
  - 9 some strains are less infective than others ;
  - 10 less reporting of new cases ;
  - 11 AVP ; e.g. fewer HIV+ babies born (to HIV+ mothers)  
     improved, screening / detection, qualified
- [max 3]

**(b) idea that estimates are subject to large uncertainty / AW ;**

*idea that needed for any use of the data for planning health services / AW ;*

*AVP ; e.g. explanation of mp 1 rather than general statement, such as*

*symptomless carriers  
 many new cases not diagnosed  
 many new cases not reported  
 remote areas*

[11]

**(c) 1 increase in new infections of HIV linked to increase in deaths from HIV/AIDS ; ora  
 in context of time delay**

**A small number deaths in 1990 as few infected eight years before**

- 2 HIV/AIDS may take several years to develop after HIV infection ;
- 3 peak for new infections is in 1997 and for deaths is 2005 (delay of 8/9/10 years) ;

*number of deaths in always lower than number of new infections*

- 4 comparative data quote in support of lower number of deaths than infections ;
- 5 not all HIV+ people die from HIV/AIDS (over period of study) ;
- 6 not all HIV+ people, have / develop, AIDS ;
- 7 many deaths of HIV+ people recorded as due to, (named) opportunistic infections ;
- 8 (antiviral) drugs delay, AIDS / opportunistic infections / AW ;

9 AVP ; e.g. cheaper drugs / greater availability of drugs [max 4]

**[Total: 11]**

**Q30.**

4 (a)

name of disease	type of causative organism	name of causative organism
cholera	bacterium / bacteria	<i>Vibrio cholerae</i>
HIV / AIDS	virus	human immunodeficiency virus;
malaria	protocist; A protozoa / protista A apicomplexa / sporozoa	<i>Plasmodium, vivax / ovale / falciparum / malariae;</i> A <i>Plasmodium (spp)</i>
tuberculosis (TB)	bacterium / bacteria;	<i>Mycobacterium tuberculosis</i>

[4]

(b) (i) cholera;

[1]

- (ii) antibiotics / antibacterials / antimicrobial and one reason;  
e.g. kill / inhibit, bacteria  
bacterial infection / caused by bacterium  
do not kill humans  
A harmless to human / AW

[1]

- (iii) 1 vaccinated children, are immune / AW;  
*ignore resistant*  
2 herd effect;  
3 explained; e.g. sufficient / AW, vaccinated / immune, to prevent spread (to susceptible individuals)  
4 example of another factor that became effective; e.g. less money spent on drugs so more for better diet  
prevention method described to avoid, food / water, contamination [max 2]

- (c) (i) 1 bacterial (surface) antigens / epitopes, act as, non-self / foreign antigens;  
2 human cells have self antigens;  
3 (antigens are), proteins / polysaccharides;  
4 (non-self antigen) will trigger phagocytosis / phagocytes have receptor (only) for, bacterial / non-self, antigens / proteins; **ora** for self antigens  
5 ref. to non-self and self antigens containing different sequences of amino acids / self antigens are products of body's genotype / AW;  
6 *idea that* phagocytes bind to antibodies complexed with (non-self) antigens (and human cells will not have bound antibody); [max 3]

- (ii) *any reasonable; e.g.*  
mechanism to prevent, phagosome formation / lysosome fusion with phagocytic vacuole  
able to withstand attack by (hydrolytic) enzymes  
contain enzyme inhibitors  
able to degrade (hydrolytic) enzymes  
protective capsule [max 1]

- (iii) reduction in numbers of T (h) lymphocytes; **A** CD<sub>4</sub> (cells) macrophages  
 ref. to role of T(h) cells e.g. enhanced humoral response, increase macrophage action;  
 lowered immune system / poor immune response / AW; e.g. unable to produce sufficient  
 T/B cells / insufficient stem cells available [max 2]

[Total: 14]

Q31.

- 2 (a) cholera and TB ;  
**ignore any other underlined diseases** [11]

- (b) *must answer in context of antibiotics, not antibodies*  
*look for bacteria in answer if not clear in mp 1*

- 1 (to ensure) all bacteria are, killed / removed / eliminated / destroyed / AW ;  
**R** virus / bacteria and virus  
*ignore antigen or pathogen or disease*  
*'all' may be implied e.g. award if gain mp 2,3,4*
- 2 (so) no reservoir of infection remains / AW / ora ;
- 3 (disease) cannot be transmitted / cannot infect others / AW e.g. spread / ora ;
- 4 no recurrence / disease does not return ; *in context of same person*
- 5 to reduce chance of / AW, (antibiotic / drug) resistance developing ;  
**R** *idea that human becomes resistant to antibiotics*
- 6 ref. to mutation in context of resistance ; [max 3]

- (c) (i) binds with / fits into / AW, active site ; **R** collides with / reacts with  
complementary shape to active site / similar shape to substrate ;  
**A** same shape as substrate / same or similar structure as substrate  
 fewer, enzyme-substrate / E – S, complexes ;  
**A** no ESC in context of one enzyme  
**A** fewer successful collisions between enzyme and substrate  
**A** prevents formation of E – S complexes  
 reduces rate of / slows (enzyme) reaction ;  
**A** reduced enzyme activity / **A** less product formed [max 3]

- (ii) *ideas that*  
 (humans) do not have the enzyme for cell wall synthesis ;  
**A** penicillin only inhibits bacterial enzymes  
 penicillin will not inhibit any human enzyme ;  
 (human cells) do not have cell walls ; [max 1]

- (iii) cell wall synthesis will stop / slow / be inhibited ;  
**A** inhibit, murein / peptidoglycan, synthesis  
 ref. to uptake of water by osmosis ;  
 cell cannot withstand osmotic stress / cell cannot withstand turgor pressure /  
 lysis / bursting / AW ;  
**A** cell wall weakened  
 bacteria die / are killed / destroyed ;  
 stops bacteria dividing / reproducing / 'replicating' ;  
**AVP** ; e.g. detail of action of penicillin (e.g. prevents cross-links forming),  
 (penicillin) only works on growing cells [max 3]

[Total: 11]

Q32.

- 3 (a) *max 1 if no ref. to TB and COPD or if correct definitions given and ref. to TB/COPD incorrect (TB is an infectious disease, COPD non-infectious)*

TB caused by, a pathogen/ *Mycobacterium*/ *M. tuberculosis*/ *M. Bovis* ; ora for COPD

A microorganism/ bacterium/ bacteria I virus/ fungus/ protoctist

A infectious disease is caused by a pathogen ora

TB is/ COPD is not, transmissible/ communicable/ can be passed from one organism to another ; *allow detail of TB transmission e.g. droplet infection / in contaminated milk*

A infectious disease is transmissible ora

COPD caused by, damage to/ irritation of, lung tissue ; AW

*accept relevant ref. to tobacco smoking*

[2]

Q33.

- 4 (a) (i) *penalise once if the term genetic material is used instead of DNA*

1 no nuclear envelope / no (true) nucleus ;

A no nuclear membrane

A no nucleus envelope

A DNA free in cytoplasm ora

A DNA as nucleoid

2 DNA, loop / circular ;

A DNA not linear

3 DNA, not in chromosomes / DNA not associated with, histones / proteins ;

A naked DNA

4 no nucleolus ;

5 (presence of) plasmids ;

6 (only) have, 70S / small / 18–20 nm, ribosomes ;

7 presence of, capsule / slime layer ;

8 ref. small (cell) size / less than 5  $\mu\text{m}$  / (only) 1  $\mu\text{m}$  ;

A ora for eukaryotes

[max 3]

(ii) *plant cell*  
cellulose ; *treat as neutral ref. to microfibrils / fibres*

*bacterial cell*  
murein / peptidoglycan ;  
A peptoglycan / polysaccharide and amino acid

[2]

- (b) 1 cell contents shrink / cytoplasm shrinks ; AW  
R cell shrinks *unless clear that the cell wall remains, intact / same size*
- 2 cell (surface) membrane / plasma membrane, peels away / AW, from cell wall ;  
A plasmolysis occurs / cell becomes flaccid
- 3 (movement of) water out by osmosis ;  
4 down water potential gradient / from high to low water potential / to lower  
water potential /from less negative to more negative water potential ;  
A  $\psi$  for water potential

[max 3]

- (c) 1 (mutation involves) change in sequence of, bases / nucleotides (of DNA);  
A (mutation leads to) altered, mRNA / codons  
A change leads to new alleles  
*(genes code for, polypeptides / proteins, so)*
- 2 different, protein structures / proteins, possible / synthesised ;  
A different, primary / tertiary / 3-D, structure
- 3 (so) range of / different, functions possible / AW ;

[max 2]

[Total: 10]







