# 10. Infectious Diseases

## 10.1 Infectious Diseases

## Paper 2

Marking Scheme

## Q1.

| | | |
|---|---|---|
| (a) | (insect) vector / *Anopheles* / (a) mosquito ;<br>*Plasmodium, falciparum / ovale / malariae / vivax* ; **A** *knowlesi*<br><br>*Vibrio cholerae* **and** cholera ;<br>**A** other pathogens and associated diseases that are transmitted in the same way<br>*Mycobacterium, tuberculosis / bovis* ;<br>airborne droplets / droplet infection / aerosol (infection) ;<br><br>**I** air droplets<br>**I** water droplets from, coughing / sneezing<br>**A** alternative transmission only if *Mycobacterium bovis* stated<br>e.g. (eating) contaminated meat (from infected cattle)<br>(drinking) contaminated milk<br>(drinking) unpasteurised milk from contaminated, cows / cattle | **5** |

| | | |
|---|---|---|
| (b) | *any **two** from:*<br>tenofovir competes with, (activated / phosphorylated) adenine nucleotide / deoxyribose adenosine triphosphate / dATP, for active site / to prevent nucleotides being added to elongating chain ;<br>**A** (tenofovir acts as a) competitive inhibitor (of reverse transcriptase)<br><br>tenofovir forms a phosphodiester bond to elongating DNA strand, but stops further reactions / AW ;<br><br>tenofovir has, no 3′ -OH so next nucleotide cannot form a phosphodiester bond / no (deoxy)ribose so cannot form phosphodiester bond ;<br>**A** pentose<br>**R** sugar unqualified | **2** |
| (c)(i) | 20 (%) ; **R** answers with decimal places | **1** |

| | | |
|---|---|---|
| (c)(ii) | *there must be at least one statement or at least one explanation to gain max 4, otherwise mark to max 3*<br><br>*any **four** from:*<br>**1** supply, condoms / femidoms / dental dams / item(s) for protection during sex ;<br>**2** barrier to transmission during sexual intercourse ;<br><br>**3** *ref. to*, needle exchange schemes / other suitable support for intravenous drug (ab)users ; **I** clean needles<br><br>**4** decreases risk of sharing contaminated equipment / AW ;<br><br>**5** use, new needles / new syringes / sterilised equipment / AW, for medical procedures ; **I** clean needles<br><br>**6** decreases risk of transmission from contaminated blood ;<br><br>**7** provide testing for HIV, in high risk groups / to individuals at high risk ;<br>**8** for early diagnosis so newly infected people so can start drug treatment immediately ;<br><br>**8** test pregnant women for HIV / provide powdered milk to women who are HIV positive ;<br>**9** prevent women who are HIV positive passing HIV in breast milk ;<br><br>**10** prevent people who are HIV positive being blood donors / screen donated blood / heat-treat donated blood ;<br>**11** prevent people receiving blood infected with HIV, during blood transfusions / operations ;<br><br>**12** carry out contact tracing ;<br>**13** locate people who, are undiagnosed / may be HIV positive / should be offered test ;<br><br>**14** supply (named) drug(s) to people, living with HIV / who are HIV positive / pregnant women with HIV ;<br>**15** prevents HIV, spreading throughout the body / infecting more T-lymphocytes ; **A** to reduce viral load<br><br>**16** provide, education / information, about, HIV treatments / HIV transmission ;<br>**17** to raise awareness of ways to reduce infection / AW ; **A** use of barrier methods during sex / safer sex<br><br>**18** AVP ; e.g. law to make it illegal to knowingly transmit the virus | **4** |

## Q2.

| | | |
|---|---|---|
| (a) | human immunodeficiency virus ; | 1 |
| (b) | *max 1 if no mention of benefit of ART*<br><br>*any **two** from:*<br>helps to, increase / maintain / AW, number of, T-,lymphocytes / T-helper cells ;<br>**A** helps to prevent death of T-lymphocytes / AW<br>**A** T-cells<br>maintains / improves / AW, strength of, immune system / immune response ;<br>increases chance of recovery from, infectious / opportunistic, disease ; AW<br>*idea that* decreases risk of having / helps prevent, other (opportunistic) diseases ;<br>AVP ; e.g. (can) decrease viral load / reduce number of HIV | 2 |

## Q3.

| | | |
|---|---|---|
| (a) | **I** protective gear / education about transmission / contact tracing / early diagnosis / testing<br><br>*any **two** from:*<br><br>practising safe sex / example ;<br>**A** protected sex / using protection during sex<br>**A** barrier contraceptives **I** use contraceptives<br><br>screening blood, donated for / before, transfusions AW<br>**or**<br>not taking blood from high risk individuals / AW ;<br><br>*idea of* treating donated blood (to inactivate viruses) ;<br>**A** example e.g. heat / chemical treatment<br>solvent-detergent treatment<br><br>*in context of drug abusers*<br>avoid sharing, needles / syringes / drug injecting equipment AW<br>**or**<br>use, new / sterile, needles / syringes / drug injecting equipment ;<br>**A** cookers / sterile containers to mix drugs<br>**A** use needle-exchange schemes / AW<br>**A** use safe injection sites / AW<br><br>avoid breast feeding / use baby milk products instead of breast milk ;<br><br>pre-exposure prophylaxis / PrEP<br>**or**<br>post-exposure prophylaxis / PEP ;<br><br>AVP ; e.g. using sterile equipment for, tattooing / surgery / dental procedures / body piercing | 2 |

## Q4.

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|---|---|---|
| (a) | *ovale / malariae* ; **A** knowlesi must be spelled correctly<br>*if both given, must be correct spelling* | 1 |

## Q5.

| | | |
|---|---|---|
| (b)(i) | *Mycobacterium tuberculosis* / *Mycobacterium bovis* ; | 1 |

## Q6.

| | | |
|---|---|---|
| (b)(i) | pathogen ; **I** parasite | 1 |
| (b)(ii) | *falciparum* / *malariae* / *ovale* / *vivax* ; **A** *knowlesi correct spelling* | 1 |

| | | |
|---|---|---|
| (c) | *any **three** from:*<br><br>*similarities*<br>vector, qualified ; e.g. vector is, an insect / a fly<br>both, are vector-borne / are carried by a vector<br>both, need / involve, a vector<br><br>(vector / carrier / insect) feeds / AW, on (human) blood ;<br>**A** both diseases transmitted through blood<br><br>*differences*<br>*malaria* (vector) is, a mosquito / *Anopheles* ; **ora** (tsetse fly) not a mosquito<br>**R** mosquito / Anopheles, versus insect<br><br>(only) female (*mosquitos*), feed on blood / transmit disease / are vectors ;<br>*(information given for sleeping sickness is that male and female tsetse flies feed on blood)* | 3 |

## Q7.

| | | |
|---|---|---|
| (a) | *Mycobacterium bovis* ; **A** *M. bovis* | 1 |
| (b) | pasteurising / drinking pasteurised, milk ; **I** vaccines / antibiotics<br>**A** heat treatment of / sterilise / boil, milk **I** cook milk<br>**A** use pasteurised milk to make dairy products<br>**A** meat from (deceased dairy) cattle should be cooked, thoroughly / AW | 1 |
| (c) | (infected), person, coughs / breathes (out) / talks / sneezes / AW, and (uninfected) animal, inhales / inspires / breathes in ;<br><br>aerosol / droplet, infection / transmission **A** transmitted by aerosol<br>**or**<br>organism / pathogen / bacteria / *M. tuberculosis*, in, airborne droplets / droplets in air ;<br>**A** contaminated, airborne droplets / droplets in air | 2 |
| (d) | *any **two** from:*<br><br>antibiotics / antibacterials ; **I** vaccines / vaccination<br><br>detail ; e.g. combination treatment / combination of antibiotics<br>**I** many antibiotics **A** many different antibiotics<br>*allow ecf e.g. if stated as drugs for mp1*<br><br>named antibiotics ; e.g. rifampicin / isoniazid / rifampentine / moxifloxacin / pyrazinamide / ethambutol *accept other correct*<br><br>four months – 12 months ; *accept range or stated months*<br>*allow 'must take for 6 months to more than 12 months' as this has noted a time less than 12 months*<br><br>shorter time using combination than single antibiotic ; | 2 |

## Q8.

| | | |
|---|---|---|
| (a)(i) | human immunodeficiency virus ; | 1 |
| (a)(ii) | *any **four** from:*<br><br>there is a decrease in the percentage infections in most regions / AW ;<br><br>*ref. to* exceptions to this decreasing trend ; e.g. **B** (Eastern Europe and Central Asia ) / **D** (Middle East and North Africa)<br><br>*allow no overall trend if mp 1 and mp 2 not awarded*<br><br>the biggest percentage decrease, in **E** (East and Southern Africa) ;<br><br>the smallest percentage decrease, in **G** (Latin America) ;<br><br>data quote to support described trend ;<br><br>AVP ; | 4 |

## Q9.

| | | |
|---|---|---|
| (a)(i) | *any **two** from:*<br>oral rehydration (salts / solution / therapy) ; **A** ORS / ORT<br>**A** rehydration therapy if *ref. to* 'drinking' stated within response<br><br>solution of / water with, glucose and salts ;<br>**A** named example for salts e.g. sodium / potassium / citrate / chloride<br><br>AVP ; e.g. antibiotics / doxycycline / tetracycline / furazolidone / choramphenicol / sulfaguanidine (*standard treatment in some countries*)<br>zinc treatment (*standard treatment for children in some countries*)<br>*ref. to* isolation | 2 |
| (a)(ii) | *any **two** from:*<br>decreases, recovery time ; **A** cured more quickly<br>**I** helps recovery / reduces severity of disease<br><br>reduces time of / stops, diarrhoea production (containing pathogen) ;<br><br>less likely to / AW, contaminate water ;<br>reduced transmission of pathogen ; AW e.g. breaks transmission cycle | 2 |

## Q10.

| | | |
|---|---|---|
| (a) | (pathogen / causative organism is) transferred / passed on / AW, (from infected) to an uninfected, person / organism ;<br>**I** disease<br>**I** from one person to another *unqualified*<br>**I** spread | **1** |

| | | |
|---|---|---|
| (c)(ii) | *large outbreaks of cholera in countries shown in Table 5.1 accept ora*<br>*any **five** from:*<br>**I** *ref. to* poverty, unqualified<br>**1** civil disturbance / (civil) war ;<br>**2** named natural disaster ; **I** famine / drought<br><br>**3** lack of, uncontaminated / AW, drinking water ;<br>**A** examples e.g. no piped water supply / no bottled water / no water treatment<br>**4** *ref. to* sewage, qualified ;<br>e.g. no sewage treatment **A** examples e.g. no separation of drainage from homes and water supplies / contamination of water supplies with human faeces<br><br>**5** poor sanitation ; *credit only if mp3 or mp4 are not awarded*<br><br>**6** *ref. to* poor personal hygiene / described example ;<br>**7** eating contaminated foods ; e.g. crops irrigated with contaminated water / seafood harvested from contaminated seawater<br>**8** slow(er) / no / little, diagnosis ;<br>**9** slow(er) / no / little, treatment / healthcare / medical facilities ;<br>**10** oral rehydration, (salts / therapy), not, provided / available ; **A** named example of oral rehydration<br>**11** antibiotics not, provided / available ;<br>**12** vaccine not provided / vaccine not available / reluctance to be vaccinated / ref to anti-vaccination campaigns ;<br>**13** poor, understanding of / education about, prevention / treatment / precautions ;<br>**14** AVP ; e.g. difficult to reach people living in, rural / remote / dangerous, areas<br>lack of trained professionals<br>antibiotic resistance<br>*ref. to* people bringing in cholera from elsewhere | **5** |

| | | |
|---|---|---|
| (c)(i) | 0.2 | **1** |

## Q11.

| | | |
|---|---|---|
| (a) | protoctist ; | 1 |
| (b)(i) | *any **two** from:*<br><br>**1** drugs have different, targets / mechanisms of action,<br>**or**<br>drugs, act on different, structures / processes / stages of life cycle ;<br><br>**2** unlikely / less likely, for mutations against all drugs to occur ;<br><br>**3** unlikely for resistance to occur against all the drugs ;<br>**I** immune / immunity<br>**A** described example<br><br>**4** if there is resistance to one, the other drug(s) will, kill / AW, all pathogens ; AW<br>**I** ref. to effective<br><br>**5** (so) prevents, gene / allele, from being passed on ;<br><br>**6** AVP ;<br>e.g. low numbers left, so less probability of mutations arising<br>*idea that* if all pathogens are killed, no replication / no mutations, for resistance to develop | 2 |

| | | |
|---|---|---|
| (b)(ii) | *allow, pathogens / parasites, for <u>Plasmodium</u>*<br><br>**I** increased time when person is infectious<br><br>*any **two** from:*<br><br>increased time when person, has *Plasmodium* in, blood / circulation ;<br>*allow mark if reference to, blood / circulation, not made but reference is made to blood in statements about Anopheles*<br>**A** person acts as a reservoir for *Plasmodium*<br><br>(so) quantity / concentration / number, of *Plasmodium*, remains high / increases ; AW<br>**A** ref. to allows *Plasmodium*, to reproduce / replicate<br>**I** ref. to genes passing to offspring<br><br>increased, time / risk / chance / AW, of, being exposed to, vectors / mosquitoes / *Anopheles* (for blood meal) ; AW<br><br>*idea of* more infected, *Anopheles* / mosquitoes available to feed on uninfected people ; | 2 |

<table>
<tr>
<td>(c)(ii)</td>
<td>
allow correct use of extracted data to help confirm points<br>
allow ideas such as higher survival = greater (partial artemisinin) resistance<br><br>
Key<br>
20 / lower concentration = 20 nmol dm$^3$ DHA<br>
700 / higher concentration = 700 nmol dm$^3$ DHA<br>
survival / survival rate = mean percentage survival rate of trophozoite<br><br>
any three from conclusions 1 to 5:
<table>
<tr><td>1 zero survival of no mutation</td><td>cultures 1 and 4 / no mutations, no survival / 0% survival rate / all killed, at, higher concentration / 700 ;</td></tr>
<tr><td>2<br>concentrations compared</td><td>lower concentration / 20, higher survival rate than, higher concentration / 700<br>ora<br>higher concentration / 700, lower survival rate than, lower concentration / 20 ;<br>general statement or can take one culture to compare</td></tr>
<tr><td>3<br>mutation (C580Y and F446I) v no mutation (control / cultures 1&4)</td><td>(A and B strains with) mutations higher survival rate than no mutation<br>ora<br>(A and B strains with) no mutation lower survival rate than mutations ;<br>general statement for both strains, or A, or B<br>(if concentrations mentioned, need to refer to both concentrations)</td></tr>
<tr><td>4<br>compare strain A with strain B</td><td>strain A higher survival rate than strain B<br>ora<br>strain B lower survival than strain A ;<br>general statement or comparing groups e.g. 1 and 4 or 2 and 5 or 3 and 6 (for both or one concentration)</td></tr>
<tr><td>5<br>C580Y v F4461</td><td>C580Y, higher survival than F446I / highest survival rate<br>or<br>F446I lower survival rate than C580Y ;<br>general statement or compare 2 and 3, or 5 and 6, for both or one concentration</td></tr>
</table>
</td>
<td>3</td>
</tr>
</table>

## Q12.

<table>
<tr>
<td>(d)(i)</td>
<td>any two from:<br><br>caused by a pathogen ;<br>idea that it is transmissible / passed from infected plant to uninfected plant ;<br>results in harm being caused / AW ;</td>
<td>2</td>
</tr>
<tr>
<td>(d)(ii)</td>
<td>protoctist ;<br><br>Plasmodium falciparum / Plasmodium malariae / Plasmodium ovale / Plasmodium vivax ; A Plasmodium knowlesi</td>
<td>2</td>
</tr>
</table>

## Q13.

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|---|---|---|
| (d) | *max 2 if not in context of the statistic stated (using only Fig. 6.1) mps 2 -8 only*<br><br>*points are in context of people who do **not** know*<br><br>*any three from*<br>1 9.2 million do not know that they are, living / infected with, HIV ; **ora** 27.7 million people know<br><br>*risk to themselves*<br>2 not accessing, ART / treatment ;<br>**A** only people who know will access ART<br>**A** if tested, can access ART<br><br>3 high(er) viral, loads / levels (compared to many on ART); **ora**<br>*idea of no control over presence of virus in body*<br><br>4 greater risk of, developing / dying from, HIV/AIDS / HIV-related diseases ; **ora**<br>**A** AIDS for HIV / AIDS<br>**R** HIV<br>*context could be, no ART / higher viral loads / no treatment of HIV-related diseases*<br>*risk to others*<br><br>5 greater risk of transmitting, virus / HIV ; **ora**<br>*includes placental transmission*<br><br>**R** HIV/AIDS or AIDS<br>*context could be, higher viral load / not practising prevention*<br><br>6 detail of prevention that may not be practised ; **ora**<br>e.g. are sharing contaminated needles<br>are donating blood<br>are breastfeeding<br>are not, practising safe sex / using condoms / AW<br><br>7 (may develop opportunistic infection so) greater risk of spreading infectious diseases ;<br>*consequence for, health care / authorities* | **3** |

| | | |
|---|---|---|
| (d) | 8 problems with increase in infection within a population ; **ora**<br>e.g. increased cost of, care / medication<br>increased pressure on medical staff<br>reduction in size of labour force<br><br>9 *ref. to* testing for HIV ; **R** testing for HIV/AIDS<br>e.g. indicates more, education / advertising, needed to encourage testing<br>indicates more testing required / focusing on at risk groups<br><br>10 AVP ; *issues for authorities other than mp 8 and 9*<br>e.g. if people do not know status, no contact tracing can occur<br>focus efforts on countries where a high proportion do not know HIV status<br>authorities provide free condoms to try and reduce overall transmission | |

## Q14.

| | | |
|---|---|---|
| (a) | **1** vector is female *Anopheles* (mosquito) ;<br>**2** mosquito / (female) *Anopheles*, takes blood from infected person ; **I** 'bites' alone<br><br>**3** (vector / mosquito / *Anopheles*) inserts / AW, saliva / anticoagulant, with, pathogen / *Plasmodium* / parasite, into (blood of) uninfected person ;<br>**R** if incorrect type of pathogen | **2** |

## Q15.

| | | |
|---|---|---|
| (d) | ***ignore*** *ref. to* sickle cell anaemia<br><br>*any five from*<br>*habitat of* Anopheles *mosquito*<br>**1** tropical / warm and humid / AW, climate / regions ;<br>**A** in context of global warming (increases life span of *Anopheles*)<br>**2** in areas where, *Anopheles* (mosquito) / vector, occurs ;<br>**3** *Anopheles* mosquitoes only live in humid conditions ;<br>**4** warm temperatures for, development / growth, of, parasite / *Plasmodium* (in vector / mosquito) ;<br>**5** warm temperature for, development / growth, of mosquito larvae ;<br>**6** mosquitoes require bodies of, still / AW, water for breeding ;<br>**A** ponds, puddles, lakes, swamps<br>**7** mosquitoes require places where there is sufficient rainfall ;<br>**8** low altitude ;<br><br>*resistance*<br>**9** insecticide / repellent, resistance of mosquitoes ;<br>**10** drug resistance of parasite ;<br><br>*prevention*<br>**11** in countries / areas, where, prevention / control measures, are not implemented by, governments / health authorities ;<br>**12** further detail e.g. any example of a, prevention / control measure that is not used or not implemented fully ;<br><br>*immunity*<br>**13** immunity to malaria in human population (limits distribution) ;<br><br>*people*<br>**14** migration of infected people from areas (with high rates of malaria) ;<br>**15** high rates of HIV infection ; | **5** |

## Q16.

| | | |
|---|---|---|
| (a) | *any* ***two*** *from:*<br><br>*infectious*<br>(baculovirus) is a pathogen / causative organism (of disease) ;<br>(baculovirus) is transmitted (from one insect host to another) / transmissible ;<br>*allow a description of transmission, e.g. transfer of, virus / pathogen, from, insect to insect / organism to organism*<br>**I** spread **R** person to person / plant to plant<br><br>*disease*<br>*idea of* causing ill-effect on insect, e.g. causes, harm / damage / loss of functioning / ill health / death ; **A** illness | **2** |

## Q17.

| | | |
|---|---|---|
| (b) | *any **three** from: penalise once if incorrect, pathogen / type of organism*<br><br>aerosol infection / droplet infection / ref. to airborne droplets ;<br>*in context of droplets containing, pathogen / virus*<br>infected person, exhales / expires / breathes out / coughs / sneezes / AW, (airborne droplets) ;<br>(airborne droplets) breathed in / AW, by, uninfected / healthy, person;<br><br>*idea of* transmitted when uninfected person touches an infected surface and puts fingers into, mouth / nose ;<br>**R** contact *without qualification* | **3** |

| | | |
|---|---|---|
| (d)(i) | (steady) increase in number of (estimated) deaths (from measles, over time / from 2000 to 2017) ;<br>**A** (relatively) constant then (steady) increase in number of (estimated deaths over time) | **1** |

| | | |
|---|---|---|
| (d)(ii) | *any **three** from*: **I** ref. to cost or mutations<br><br>**1** as (global) population increased, higher, number / proportion, of unvaccinated ; **ora**<br><br>**2** *ref. to* HIV link to measles ;<br>e.g. increase in number of people living with HIV increases spread of measles<br>increase in cases of HIV / AIDS, measles can be an opportunistic disease **R** spread of HIV / AIDS<br>weakened immune system in people with HIV / AIDS so measles more likely to occur (in unvaccinated)<br><br>**3** less / no, herd immunity (so increased chance of getting measles) ;<br>**A** *ref. to* larger, number / proportion, unvaccinated will increase risk of spreading disease *context is community*<br><br>**4** one example of a difference between unvaccinated versus vaccinated ;<br>e.g. risk of <u>death</u> from measles is higher in unvaccinated<br>unvaccinated do not have, (artificial active) immunity / memory cells *context is individuals*<br><br>**5** suggestion as to why fewer people are vaccinated ;<br>e.g. reluctance, of parents to get child vaccinated<br>reluctance because of, cultural / religious, beliefs<br>difficulty in obtaining vaccine *in context of remote communities*<br>collapse of vaccination programmes in some countries / AW<br>lack of, trained trained professionals / health facilities, to deliver vaccine<br>lack of education about benefits of vaccine / AW<br><br>**6** suggestion as to why measles cases (and so deaths) may increase ;<br>e.g. (greater proportion of people) malnourished / lack vitamin A<br>(greater proportion of people) living in, overcrowded / poor, conditions<br>**I** overcrowded countries<br>measles is easily spread (with increase in population) **A** very infectious<br>measles is more easily spread in overcrowded conditions | **3** |

| | | |
|---|---|---|
| (d)(ii) | **7** example of spread (of measles) owing to movement of people between countries ;<br>e.g. (unvaccinated) people with measles arriving to a country and spreading disease<br>unvaccinated people travelling to countries with the disease, catching measles and taking it back home<br>people arriving with measles to countries with low vaccination rates<br><br>**8** AVP ; e.g. ref. to, no / any specific difficulty for, contact tracing<br>lack of, isolation / quarantining<br>poor epidemiological records so authorities cannot react to outbreaks<br>improved, recording / reporting, of deaths over the time period | |

## Q18.

| | | |
|---|---|---|
| (a) | *one mark for infected person with contaminated faeces*<br>faeces / sewage, contaminates, (drinking) water / cooking utensils / vegetable plots / crops / food ;<br><br>*one mark for uninfected person*<br>drinking contaminated water / eating food washed in contaminated water ;<br>**R** infected food or water ;<br>**A** faecal-oral route *for two marks* | **2** |

## Q19.

| | | |
|---|---|---|
| (a) | *Mycobacterium tuberculosis* ; **A** *Mycobacterium bovis* | **1** |
| (b) | *any one from*<br>live in an area that has cases of TB ;<br>recently returned from countries with TB ;<br>born in a country with TB ;<br>parents / grandparents whose origin country has TB ;<br>contact with a person who has TB ;<br>AVP ; e.g. *ref. to* compromised immune system<br>mother who is HIV-positive | **1** |

| | | |
|---|---|---|
| (c) | *any three from*<br>decrease in incidence over time for all groups<br>*or*<br>decrease in incidence over time for low, lower middle, upper middle and plateau for high income group ;<br><br>one example of, large / AW, differences in incidence ;<br>e.g. between, upper middle income and, low / lower middle<br>between high income and, low / lower middle / low and lower middle ;<br>between upper middle and high ;<br><br>decrease in incidence with income group increase (for each year), generally / overall / except for 2015 / 2016 low to lower middle ;<br><br>low and lower middle similar incidence ;<br><br>data / manipulated data, to support any of above points ; | **3** |

## Q20.

| | | |
|---|---|---|
| (a)(i) | *Mycobacterium tuberculosis* or *Mycobacterium bovis* ; | **1** |
| (a)(ii) | *max1 if no reference to, infected / uninfected*<br>airborne droplets, breathed / sneezed / AW, out by infected person ;<br>breathed in / inhaled / inspired, by uninfected person ;<br>**or**<br>*in context of M. bovis only*<br>contaminated meat / unpasteurised milk, from infected, cattle / cows ;<br>ingested by uninfected person ; | **2** |

| | | |
|---|---|---|
| (d) | *any three from:*<br>*Mycobacterium* / TB bacterium, is an intracellular parasite / lives inside host cells ;<br>antibodies have no effect on bacteria inside cells ;<br>only when bacteria are in the, plasma / tissue fluid ;<br><br>*idea that* vaccination is not a global occurrence ;<br>e.g. not part of vaccination programme in many countries<br>only some countries have as part of their vaccination programme<br><br>BCG is not very effective (for adults) / some people do not respond to BCG ;<br><br>BCG does not have the same effectiveness across the world ;<br><br>many countries, have no herd immunity / do have enough people that are immune, to prevent spread ;<br><br>ref. *to* civil disturbance / AW, collapse of health services ;<br><br>AVP ; *idea that* travellers / tourists / immigrants / displaced people, may be infected with TB and transmit it to host population (that does not have, a vaccination programme / herd immunity) | **3** |

**Q21.**

| | | |
|---|---|---|
| (a)(i) | *Mycobacterium tuberculosis*<br>or<br>*Mycobacterium bovis* ; | **1** |

**Q22.**

| | | |
|---|---|---|
| (b) | *(Plasmodium / P.),* <u>*ovale*</u> */* <u>*falciparum*</u> */* <u>*malariae*</u> */* <u>*vivax*</u> *; correct spelling*<br><br>**I** *if Plasmodium is written after the species name*<br>*if more than one given, all must be correct* | **1** |
| (c) | *any one valid suggestion:*<br><br>male does not, need protein for <u>egg</u> production / produce <u>eggs</u> ;<br>**R** larvae<br>**I** male does not reproduce<br><br>male does not have mouthparts for piercing skin ; AW<br>e.g. no 'needle' to pierce skin (to suck blood)<br><br>adult male does not feed ;<br>adult male feeds (only) on, plants / nectar ;<br>blood is toxic to males ;<br>can't detect presence of, humans / mammals ;<br>male does not produce anticoagulant (for blood) ; | **1** |

| | | |
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| (d) | *accept mosquito or vector for Anopheles*<br>*accept, pathogen / parasite, for Plasmodium*<br><br>*max 2*<br>**1** *idea that* individuals / people, taking antibiotics for bacterial diseases will pass on antibiotics to *Anopheles* when it feeds ;<br>e.g. blood taken by *Anopheles* contains antibiotics<br><br>**2** (so) antibiotics kill bacteria (in *Anopheles* gut) ;<br>*must be in context of gut bacteria*<br><br>**3** decreased / no, competition between, *Plasmodium* and (gut) bacteria (so more *Plasmodium* survives) ;<br><br>**4** higher survival of *Plasmodium* makes effective (*Anopheles*) immune response more difficult ; AW<br>*(so Anopheles more likely to pass on Plasmodium)*<br><br>*max 2*<br>**I** ref. to antibiotic resistance<br><br>**5** use of antibiotics may increase, incidence / number of cases of, malaria ;<br><br>**6** and **7** *two marks for* examples of what doctors need to consider ;<br>e.g. need to balance antibiotic intake with increased risk of malaria transmission<br>*idea that* do not want to stop people taking antibiotics / antibiotics needed to fight (bacterial) infections<br>treat for malaria before giving antibiotics for (non-serious / non-life threatening) bacterial infections<br>only prescribe antibiotics that have, no / low, impact on bacteria in *Anopheles* (gut)<br>(consider) avoiding use of antibiotics to treat malaria<br><br>**8** AVP ;<br>e.g. need to research which antibiotics have this effect look for alternatives to antibiotics to treat bacterial infections | **3** |

## Q23.

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| (b)(i) | 0.8 % ; **R** 0.80 % | **1** |

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| (b)(ii) | *any two from:*<br><br>delay in / no, diagnosis ;<br>delay in / no, treatment / therapy ;<br>**A** feature of, oral rehydration, treatment /solution **A** ORT / ORS<br>e.g. lack of supply of ORT<br>unwillingness by health workers to give ORT<br>greater belief in herbal remedies<br>thinking drug treatment is sufficient<br>lack of clean water to make up ORT solution<br>no rehydration programmes<br>**I** improper treatment / treatment not effective<br>*ref. to* no / lack of, antibiotic therapy ; e.g. lack of supply of / less efficacious (AW) antibiotics used / less supervision in taking full dose<br>*ref. to* antibiotic resistant strains ;<br>*idea that* already have a weak immune system / malnourished ;<br>**A** may have HIV/AIDS (hence weak immune system) | **2** |
| (c)(i) | *any one from:*<br><br>damaged sanitation system / poor sanitation following earthquake ;<br>**I** poor sanitation unqualified<br><br>damage to, sewage treatment plants / water purification plants ; AW<br><br>(contaminated) sewage contaminates drinking water ; **I** pollution<br>**A** water becomes contaminated<br><br>lack of purified drinking water; **A** lack of, clean / treated / safe / bottled, water<br><br>AVP ; no, proper / safe, disposal of sewage | **1** |

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| (c)(ii) | *any three from:*<br><br>**1** 2011, peak in / highest / AW, number of, cases / countries / countries and cases ;<br>**A** decrease, increase in 2011, decrease *for countries*<br>**A** increase to 2011 and decrease *for cases*<br><br>**2** (2010 outbreak in) *ref. to* Haiti and epidemic (so high number of 2011 cases) ;<br>**3** *ref. to* spread of disease to countries neighbouring Haiti (hence increase in countries in 2011) ;<br>**4** overall / generally / AW, decrease in number of countries with cases of cholera<br>**or**<br>2008 54–56 countries and 2015 41–43 countries, with ref. to decrease ;<br>*decrease, peak at 2011 / increase in 2011, decrease is mp1 only*<br>**5** suggestion for trend in decrease in number of countries ;<br>e.g. improved infrastructure for sewage / water treatment<br>improved health education to prevent spread<br>providing piped (treated) water<br>**6** 2008–2010 number of cases increased and number of countries decreased ;<br>**7** AVP ; e.g. lowest / AW, number of cases in 2013<br>**R** if also state that 2013 is lowest for countries<br>similar number of countries in 2008 and 2011 but, approx 3× / much higher / stated values, number of cases in 2011 | **3** |

## Q24.

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| (d) | *two from:*<br><br>*non-infectious*<br>not from a pathogen ; **A** bacteria / viruses / fungi *for pathogens*<br>**A** from lifestyle<br>**A** tar / carcinogen in smoke, causes mutation (in cells of lung)<br><br>cannot be passed onto another person / not transmissable / AW ;<br><br>*disease*<br>abnormal condition (affecting an organism) / condition that reduces the effectiveness of the functions of the organism / AW ; | **2** |

## Q25.

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| (b)(i) | one value in the range 64% – 68% ;<br>*((940 000 – 980 000) ÷ (1 440 000 – 1 480 000)) × 100* | **1** |
| (b)(ii) | *allow women for pregnant women and therapy / treatment, for ART*<br>*any three from*<br>**1** (slight) decrease in (total) number of women living with HIV and (overall) increase in number of women living with HIV receiving ART ;<br><br>**2** slight decrease / plateau / AW, between 2009 to 2010, in number of women living with HIV receiving, ART / therapy ;<br><br>**3** proportion / percentage cover(age), of women receiving ART increases (in time period) ;<br>**A** calculated values (approx. 13% to 66%)<br>**A** number of women receiving ART increases more steeply than decrease in number of women living with HIV<br><br>**4** data to support mp1 or 2 ; *mp1 two years and, two values / manipulated data, for either curve*<br>*mp2 two values, 2009 compared to 2010* ***or*** *manipulated data*<br>*allow ± 20 000 for extracted values* | **3** |

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| (b)(iii) | *in context of pregnant and breastfeeding women who are living with HIV*<br>*any three from*<br>**1** *ref. to* mother to child transmission ; *in context of HIV transmission*<br>**A** (because) HIV can be passed from mother to baby<br>**A** decreases HIV transmission during, pregnancy / labour / birth / breastfeeding<br>**A** reduces, number / proportion, of babies born with HIV (so fewer die)<br>**I** stops transmission *(as this is in context of global transmission this implies in all cases)*<br>**I** makes babies immune to HIV / AW or gives passive immunity<br>*allow idea that ART may be passed across, placenta / breastmilk, to baby and so provide(short-term) protection against any HIV transmitted from mother*<br><br>**2** reduces number of, HIV positive women becoming ill (with HIV/AIDS) /women with HIV/AIDS dying from the disease ;<br>**A** opportunistic infections / named examples e.g. TB<br><br>**3** example of reduces spread of HIV ;<br>*in any correct context other than HIV mother to child*<br>e.g. child may grow up without HIV and will not pass on<br>mother less likely to pass on to partner<br><br>**4, 5** examples of, social / economic, effect ;;<br>e.g. (healthy women) can contribute to work force<br>can be main carer if partner has died (*idea that* children not orphaned)<br>overall financial savings<br>e.g. if infants are not born with HIV then no lifelong ART required<br>ART may be less costly than treating HIV/AIDS<br>makes breastfeeding safer when no other options exist to feed babies<br>HIV negative children will become next workforce generation<br>all women throughout world receive same treatment | **3** |

## Q26.

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| (c) | *Plasmodium, falciparum* / *vivax* / *ovale* / *malariae* ; | **1** |
| (d) | *any three from*<br>*pathogen*<br>(because) four / several, different, causative species / AW, (with different antigens) ;<br>(pathogen has) many antigens as it is eukaryotic / many genes coding for antigens ;<br>*ref.* to mutation changing antigens ;<br>pathogen has different stages of life cycle (within human) with different antigens ;<br>**I** *ref.* to antigenic shift<br>antigenic concealment / pathogen spends part of life cycle within host cells / AW ;<br>**A** short time in blood plasma<br><br>*vaccine*<br>*ref.* to more than one type of vaccine needed ;<br>suggestion that antigens used have not given the strongest immune response ;<br><br>*vaccination programme*<br>*ref.* to only trial programmes ;<br>**A** programmes not global<br>*ref.* to not achieving herd immunity / not enough people (successfully) vaccinated ;<br>detail ;<br>e.g. lack of willingness to be vaccinated<br>lack of trained people to give vaccines<br>poor nutrition and poor immune response | **3** |

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| (e) | *allow* *mosquitoes* / *vectors, for Anopheles*<br>*pathogen* / *parasite, for Plasmodium*<br><br>*any four from (max 1 for list of factors without explanation)*<br>*assume in context of comparison with area* ***Q***<br><br>*ref.* to a suitable climate for *Anopheles,* e.g. tropical / subtropical / hot and humid ;<br>presence of *Anopheles* species which carry *Plasmodium* ;<br>*ref. Anopheles* breeding sites present / (many) water sources (suitable for breeding) ;<br>difficulty in controlling / lack of control, of *Anopheles* breeding sites ; AW, e.g. stagnant water not drained<br>lack of / cannot afford, spraying with, insecticide / pesticide / repellents ;<br>insecticide-resistant forms of *Anopheles* exist ;<br>lack of / insufficient use of, mosquito nets ;<br>mosquito nets not impregnated with insecticide ;<br><br>lack of, artemisinin drugs / drugs to treat disease ;<br>drug-resistant forms of *Plasmodium* exist ;<br>idea of *Plasmodium* requiring temperatures of approximately 20 °C (in vector) ;<br>**A** area **P** has temperature / conditions for survival of *Plasmodium*<br><br>*ref.* to difficulties in diagnosing disease (so delay / no treatment) ; e.g. lack of diagnostic tests lack of trained personnel<br><br>AVP ;;<br>e.g. some countries in area **Q** have *Anopheles* but control is good,<br>*ref.* to feature of *Anopheles* species present in area **P**<br>feed at all times during the day<br>feed only on humans<br>good host for reproduction of *Plasmodium*<br>poor education so people don't know how to protect themselves from malaria | **4** |