ANSWERS & MARK SCHEMES

DISEASE / IMMUNOLOGY

QUESTIONSHEET 1

(a) The person produces an immune response | The person produces memory cells | The immunity can be acquired naturally and artificially

| Passive immunity | ✗ | ✗ | ✓ |
| Active immunity | ✓ | ✓ | ✓ |

One mark per correct row. 2

(b) living but modified microorganism;
given heat/chemical treatment;
reduced reproduction rate/eq.; max 2

(c) more closely resembles a real infection;
provokes a better immune response/killed organisms may have modified antigens;
smaller initial inoculum needed;
imunity is longer lasting; max 2

TOTAL 6

QUESTIONSHEET 2

(a) (i) C;
(ii) B; 2

(b) infects red blood cells or lives/reproduces inside red blood cells;
and in liver cells;
antigens (on surface) not exposed to/hidden from immune system/eq.;
different stages have different antigenic groups;
keeps changing its antigenic groups; max 3

(c) advantage: surrounded by digested food materials/sugars for respiration/amino acids for growth/eq.;
disadvantage: exposed to digestive enzymes/extreme pHs; 2

TOTAL 7
QUESTIONSHEET 3

(a) (i) antigen/eq. on surface of virus;
fits with/locates onto/eq. receptor molecule on T cell;  
(ii) X: reverse transcriptase;
enzyme catalyses/promotes transcription/synthesis of DNA from (viral) RNA;  
Y: DNA polymerase;
assembles single stranded DNA into double stranded DNA;  
(iii) viral DNA transcribes messenger RNA;
and new viral RNA;
messenger RNA carries code for amino acids as triplets of bases/codons;
to ribosomes;
viral protein assembled;
viral protein and viral RNA assembled into new virions/virus particles; max 4

(b) (i) globular protein;
produced in response to a specific antigen;
by B lymphocytes; max 2  
(ii) mix HIV antigens with sample of patient’s blood;
look for evidence of agglutination/reaction;  
(iii) virus multiplies rapidly;
so many T cells destroyed/virus causes T-helper cell/lymphocytes to lyse;
T-helper cells induce B-lymphocytes to secrete antibodies/ref interleukins;
thus antibody formation is impaired (fall on graph);
thus more susceptible to infection/virus causing tumours; max 3

TOTAL 17

QUESTIONSHEET 4

(a) blockage/build up of fatty material/atheroma/lipids;
in coronary arteries/arteries which supply the heart;
resulting in heart muscle/myocardium receiving insufficient oxygen; max 2  
(b) (i) (risk of) mortality from CHD increases in diabetics;
for both sexes;  
(ii) transport cholesterol to liver for metabolism;
therefore lower cholesterol levels;
thus reduce the risk of developing atheroma/plaque; max 2  
(c) between the ages 20 - 50 men have higher LDL cholesterol levels;
possible explanation for higher CHD mortality rate;
due to greater likelihood of developing atheroma/plaque; max 2  
(d) smoking;
genetic;
hypertension;
obesity;
synthetic oestrogens/contraceptive pill; max 2

TOTAL 10
**QUESTIONSHEET 5**

(a) (i) plasma cells; 
(ii) binding sites attach to recognition sites/antigenic sites on bacteria/viruses/pathogens; hinges allow antibody ‘arms’ to close or spread; enables attachment to antigens at different distances apart/gives ability to cope with variability of the bacteria/viruses; antibody molecules tend to group together/form groups of five; (thus) can clump bacteria/viruses together into masses; which can then be phagocytosed/ingested by macrophages; max 4 
(iii) secrete interleukins; (this) induces antibody formation by plasma cells/descendents of B-cells; (this) stimulates the multiplication of killer T-cells; (and) the differentiation of more killer T-cells (at the site of infection); max 3 

(b) memory cells (stored in the lymphatic tissue) recognise the original antigen; if the same pathogen infects the body at a later date, the memory cells bring about a much faster/larger response; thus the pathogen is destroyed before symptoms are noticable; ref to memory T-cells and memory B-cells; max 3 

TOTAL 11

**QUESTIONSHEET 6**

(a) (i) antibiotics do not act against viruses; since antibiotics cannot enter cells/cross cell membranes (and viruses are inside the cells); constant exposure of bacteria to antibiotics selects resistant strains; which arise by gene mutation; thus reducing the effectiveness of the antibiotics when they are required/puts patients at risk/makes treatment more difficult; will also save money since antibiotics are expensive/makes money available for other treatments; max 3 
(ii) ref to need to maintain antibiotic concentration (in patient) high enough for long enough; to kill all infecting bacteria/some bacteria may take longer than others to be killed; some antibiotics only inhibit bacterial growth/are bacteriostatic, giving a chance for the immune response to kill the bacteria; if the treatment stops too soon residual populations of the bacteria may multiply causing reinfection; these bacteria may also acquire antibiotic resistance; max 3 
(iii) intravenous injection enables a high concentration of antibiotic to reach the bacteria (almost) immediately; important if bacteria are multiplying quickly/dangerous/labile to overwhelm patient/ref bacterial meningitis; tablets take time to be absorbed into blood/diluted by gut contents/takes longer to reach bacteria in adequate concentrations; max 2 

(b) should have minimum side effects/not cause allergic responses; must be able to reach site of infection in adequate concentrations; should be effective within a reasonable time period; must not interact with other drugs being taken (by the patient); should be effectively bacteriocidal/bacteriostatic against the infecting bacteria; should not be rapidly broken down by the body/body’s metabolism/should not form harmful byproducts; max 3 

TOTAL 11
ANSWERS & MARK SCHEMES

QUESTIONSHEET 7

(a) bacteria + any named bacterial disease/diphtheria/whooping cough/tetanus;
   viruses + any named viral disease/polio/measles/mumps/AIDS/chicken pox;
   protozoa + any named protozoal disease/malaria/amoebic dysentery/sleeping sickness;
   fungi + any named fungal disease/ringworm/farmer’s lung/Aspergillosis/thrush;  

(b) (name of condition = 1, cause/defect = 1)
   Down’s syndrome;  trisomy 21/non-disjunction;
   Turner’s syndrome;  XO/non-disjunction;
   Klinefelter’s syndrome;  XXY/non-disjunction;  

(c) diabetes (mellitus)/sugar diabetes;
   failure to produce insulin/insulin does not work properly;
   insufficient (blood) glucose converted to (liver/muscle) glycogen;
   (thus) blood glucose level raised/glucose leaks into urine;  
   ref to possible ketosis/formation of ketone bodies;  (accept other diseases with appropriate comments)  

(d) diseases due to inadequate diet;
   kwashiorkor is due to a lack of dietary protein/lack of essential amino acids;
   marasmus is due to a lack of dietary protein and calories;  

(e) ionising radiation/α-rays/β-rays/γ-rays/X-rays;
   mutagenic chemicals/mustard gas/dioxane/any correct example;  

(f) (i) greater chance of developing bronchitis/chronic lung infections/pneumonia;
   greater chance of developing emphysema/degeneration of elastic tissue in lungs;
   greater chance of developing lung cancer;
   greater chance of developing heart disease/peptic ulcers/gangrene;  

(ii) increased risk of gastritis/inflammation/irritation of the stomach lining;
   development of obesity (since alcohol contains a lot of calories);
   development of liver damage/cirrhosis;
   development of dementia/loss of mental ability (since alcohol destroys brain cells);
   risk of malnutrition/lack of vitamin/protein intake (since alcohol suppresses appetite);  

(g) hay fever;
   allergy to penicillin;
   food allergy/allergy to nuts/allergy to gluten/any other correct example;  

TOTAL  22
QUESTIONSHEET 8

(a) (i) antibiotic is produced by microorganisms/fungi/bacteria;
will kill/inhibit the growth of other microorganisms;
antibodies are produced by cells/B-lymphocytes of the immune system;
bind specifically to pathogens/bacteria/viruses causing their destruction;
antibiotics are non-protein chemicals, antibodies are protein/gamma-globulins;  
max 4

(ii) antibiotic injected into blood is carried directly to the infected tissue;
only has to leak through the capillary walls in the tissue;
thus a high concentration is achieved quickly (but does not last as long);
antibiotic injected into muscle has to be absorbed into blood capillaries (of muscle);
and released from blood capillaries in infected tissue;
thus levels do not rise as high but last longer (than when injected into blood);
antibiotic/tablet taken by mouth gets diluted by gut contents/has to dissolve;
has to be absorbed through gut wall to blood and then released to infected tissue;
thus lower concentrations obtained but the effect lasts longest;  
max 6

(iii) broad spectrum antibiotics act against a wide range of microorganisms;
used when it is not essential to identify the infecting organism/eliminate the need for laboratory testing to identify the organism;
narrow spectrum antibiotics only act on a small range of microorganisms;
used when the infecting organism has been identified/is known;
ref to use of broad spectrum antibiotics being more likely to result in development of antibiotic resistance/
narrow spectrum antibiotics less likely to result in development of antibiotic resistance;  
max 3

(b) to give passive immunity/immediate immunity;
when there has been a possible infection of tetanus/rabies/any other correct example;
when there is a risk that the body would succumb to the infection before active immunity could develop;
gives short term protection only/protects body until active immunity can develop;
ref to snake anti-venoms;  
max 3

TOTAL 16

QUESTIONSHEET 9

(a) HIV is an RNA virus/retrovirus;
reverse transcriptase makes viral/copy DNA from the viral RNA;
this viral DNA inserts itself into the host cell DNA/chromosomes;
can remain latent in host DNA until activated;  
max 3

(b) HIV cells only grow in/infect T-helper cells/T4 cells;
bind specifically to the CD4 surface protein on T-helper cells;
insects do not contain T-helper cells/T4 cells/CD4 surface proteins;
any HIV viruses in blood meals will be destroyed/digested by insect digestive juices;
Anopheline mosquito has the necessary recognition factors/receptors to carry Plasmodium;  
max 3

(c) cat HIV viruses have different surface antigens to human HIV virus;
thus do not/cannot attach to the CD4 protein/acceptors on T-helper cells;  
2

(d) HIV viruses infect T-helper cells thus reducing their activity/destroying them;
ref interleukin production;
T-helper cells normally stimulate antibody production by B-lymphocytes/plasma cells;
stimulate greater production of T-killer cells;
thus antibody response/cytotoxic response of body is diminished;  
max 3

TOTAL 11
**QUESTIONSHEET 10**

(a) retains a high sodium concentration in the lumen; 
thus osmotically retains water/draws more water into gut from blood;  
2

(b) enables glucose and sodium channel to work thus enhancing solute uptake; 
thus water taken from the gut to blood osmotically;  
2

(c) no; 
extra glucose would hold water in the lumen by osmosis;  
2

(d) yes;  
starch osmotically inactive and will release glucose over a longer time;  
2

**TOTAL 8**

**QUESTIONSHEET 11**

(a) plaque causes narrowing of artery/lumen; 
impedes flow of blood to heart muscle; 
increases risk of clot/increases blood pressure; 
heart muscle will die (heart attack) if O₂ supply reduced too much;  
max 3

(b) smoking;  
high levels of blood cholesterol;  
high alcohol intake;  
high levels of LDLs;  
diabetes mellitus ;  
genetic;  
age;  
max 4

(c) dilation/relaxation of arteries reduces blood pressure; 
reduces workload of heart; 
therefore reduces oxygen demand of heart; 
dilation of coronary arteries improve blood supply to heart muscle;  
max 3

**TOTAL 10**

**QUESTIONSHEET 12**

(a) Any two from:  
diabetes mellitus/high blood level of low-density lipoprotein (LDL)/high blood cholesterol level/ hypertension;;  
2

(b) synergistic effect with other factors;  
smoking reduces HDL:LDL ratio;  
smoking increases blood pressure/heart rate/cardiac output/ vasoconstriction of peripheral arteries/blood glyceride concentrations;  
CO binds to haemoglobin/myoglobin/cytochrome oxidase;  
CO may increase permeability of endothelium of coronary arteries;  
nicotine may directly damage endothelium of coronary arteries;  
smoking increases platelet aggregation/adhesiveness/blood viscosity;  
max 5

(c) (i) chest pains which radiate down left arm/ref. referred pain; 
breathlessness/muscular weakness/profound tiredness;  
max 1

(ii) shortage of oxygen/glucose in the heart muscle; 
due to impeded/reduced blood flow;  
heart muscle becomes severely fatigued/cramp;  
max 2

**TOTAL 10**