

The immune system

Mark Scheme 2

| | |
|------------|-----------------------|
| Level | International A Level |
| Subject | Biology |
| Exam Board | CIE |
| Topic | Immunity |
| Sub Topic | The immune system |
| Booklet | Theory |
| Paper Type | Mark Scheme 2 |

Time Allowed : 47 minutes

Score : / 39

Percentage : /100

Grade Boundaries:

| A* | A | B | C | D | E | U |
|------|-------|-----|-------|-------|-----|------|
| >85% | 77.5% | 70% | 62.5% | 57.5% | 45% | <45% |

- 1 (a) (i) **X** – (ciliated) epithelium ;
Y – red blood cell/erythrocyte ; [2]
- (ii) cilia beat to move mucus (up the bronchiole/towards the mouth/away from the lungs/AW) ;
 mucus as a barrier to entry into (epithelial) cells ;
 mucus traps, pathogens/bacteria/microbes ; *accept in context of goblet cells*
 capillary/blood vessel, brings, phagocytes/macrophages (to engulf bacteria) ; [max 3]
- (b) (i) **J** – phagocytosis/endocytosis/described in terms of engulfing or forming phagosome ; [1]
- (ii) digestion of bacteria/described ;
 to destroy bacteria/pathogen ; **A** to prevent spread through the body
 antigen, presentation/display on cell surface ;
idea of selection of specific, B cells/T cells ;
A recognition/binding of/activation of, appropriate B/T cells [max 2]
- (c) 1 faster ;
in context of whole secondary response
- 2 memory cells;
in context of production during the first response
- 3 *idea that there are many more cells specific for this pathogen ;*
- 4 (so) increases chances of encountering pathogens more quickly/AW ;
- 5 fast(er) production of, B lymphocytes/plasma cells/antibodies/helper (T) cells/cytotoxic T cells/cytokines ;
- 6 greater concentration of antibodies (in, blood/lymph) or greater numbers of, B/plasma, cells ;
A more, antibodies/plasma cells/B cells
- 7 pathogen, removed/killed, faster ;
- 8 person does not become ill/no symptoms ;
A pathogen does not, spread through the body/infect cells/AW [max 3]

- (d) (i) little / no / slower / weak, immune response ;
stated function of T-lymphocytes, does not occur / occurs slowly ;
e.g. release of cytokines / stimulating macrophages / stimulating B cells /
killing infected cells
high susceptibility to infectious diseases ;
R 'fighting disease'

[max 1]

- (ii) pathogen **not** recognised, as non-self / foreign ;
pathogen is recognised as self ; **A** non-foreign
ignore antigen concealment

[max 1]

- (iii) no, antibodies / plasma cells / memory (B) cells, produced ;
no humoral response ;
no antigen presentation by B cells ;

[max 1]

[Total: 14]

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- 2 (a) 5/6 correct = 3 marks 3/4 correct = 2 marks /2 correct = 1 mark
 hint: use green blobs for correct

| infectious disease | name of causative organism(s) | type of causative organism | main mode of transmission |
|--------------------|---|---|---|
| HIV/AIDS | human immunodeficiency virus (HIV) | virus | sexual contact |
| cholera | <i>Vibrio cholerae</i> | bacterium A bacteria | ingestion of contaminated water and food |
| tuberculosis | <i>Mycobacterium, tuberculosis</i> or <i>M. bovis</i> | bacterium | / droplet infection A described A airborne droplets R air droplets alone |
| measles | <i>Morbillivirus</i> ; A morbillivirus A Morbillivirus A Morbilli | virus | aerosol/ droplet, infection |
| malaria ; | <i>Plasmodium vivax</i> or <i>P. malariae</i> or <i>P. falciparum</i> or <i>P. ovum</i> | protocist ; A protozoa A protist(a) | feeding / sucking blood / AW, by <i>Anopheles</i> / mosquito ; A mosquito / <i>Anopheles</i> , bite A mosquito / <i>Anopheles</i> , is vector |

[max 3]

- (b) responses do not have to be presented as a table or confined to any one column
 for each numbered mark point, accept point either in left hand column or right hand column

A femidom for condom where relevant
 A prophylactic for condom

| mp | factors to consider | recommendations |
|----|---|--|
| 1 | (geographical) availability of condoms | condoms should be available (in all relevant locations) ; |
| 2 | where available, insufficient stock of condoms | condoms should be stocked in sufficient quantities ; |
| 3 | condoms (available but) unaffordable | free/affordable, condoms (should be provided) ; A condoms should be provided |
| 4 | low level/no, advertising campaigns for condom use | ref. advertising campaigns for, condom use / safe sex / protective sex ; |
| 5 | poor condom storage (idea of deterioration) | safe storage of condom supplies (to avoid deterioration) ; |
| 6 | lack of education in, use of condoms / how HIV is spread / other relevant R low level of awareness of HIV / lack of education about HIV | ref. education ; e.g. should use condoms / proper use of condoms A (should practice) safe sex / protective sex |
| 7 | low level of (interest in) condom use or, religious / cultural, objections A few people use condoms | ref. changing perception of people to encourage use (of condoms) ; |
| 8 | identifiable, high risk / named high risk, groups e.g. sex workers, (male) homosexuals, multiple partners, IV drug abusers (<i>in context of sexual activity</i>) | idea of targeting, high risk / named high risk, groups ; e.g. sex workers, homosexual male multiple partners, IV drug abusers IV drug abusers (<i>in context of sexual activity</i>) |
| 9 | low rate of male circumcision | encourage circumcision procedure / train health personnel ; |
| 10 | poor treatment of sexually transmitted infections | treatment of sexually transmitted infections (as risk of contracting HIV increases) ; |
| 11 | no / poor / AW , antiretroviral therapy | ref. antiretroviral therapy reducing risk of sexual transmission ; |
| 12 | ref. extent of contact tracing | ref. to contact tracing ; |

[max 4]

- [1]

(ii) *this may be answered in one of two ways ora*

[max 3]

3 (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** CD₄ (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]

