

Antibodies and vaccination

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Immunity
Sub Topic	Antibodies and vaccination
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : 74 minutes

Score : / 61

Percentage : /100

Grade Boundaries:

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

- 1 (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]

CHEMISTRY ONLINE
— TUITION —

- 2 (a) (i)**
1. ref. antigen presenting cells ;
 2. (antigen) A recognised as, non-self / AW ;
 3. by B lymphocytes;
 4. with appropriate, receptor / antibody / immunoglobulin ;
 5. ref. clonal selection ;
 6. (B lymphocytes) clonal expansion / mitosis / cell division ;
 7. T-helper cells to stimulate B-cell (response) ;
 8. releases cytokine;
 9. (B lymphocytes) mature into plasma cells ;
 10. (plasma cells) secrete (anti-A) antibody ; [4 max]
- (ii)** plasma cell fused with, myeloma / cancerous / malignant, cell ; [1]
- (iii)**
1. B cells / plasma cells, will not grow in culture / cannot divide (AW) / short-lived ;
 2. cancerous / malignant / myeloma, cells divide, indefinitely / continuously
or
hybridoma divides (AW) indefinitely ;
 3. AVP ; e.g. to obtain, genetic material / genes / genomes, from both cells [2 max]
- (iv)** use of marker described (attached to, antigen A / specific mAB against mouse antibody); [1]
- (b) (i)**
1. all infliximab treatments reduce percentage with increased joint damage ;
 2. (general trend) high dosage / more infliximab, percentage with increased joint damage lower
or
low dosage / less infliximab, percentage with increased joint damage higher ;
 3. both increasing dosage & decreasing time intervals have an effect;
 4. at high dosage increasing time interval shows, percentage with increased joint damage is similar / AW ;
 5. at low dosage increasing time interval shows, the percentage with increased joint damage is less / AW;
 6. 30.5% with no infliximab to 0.5 – 1.0% with most infliximab / 30% decrease ;
 7. other comparative data ; [3 max]

(ii) because small numbers involved / AW ;

[1]

(c) *N.B. diagnosis not treatment*

1. quick diagnosis;
2. than having to culture pathogen ;
3. (quicker diagnosis) so quicker treatment ;
4. less labour intensive (than culturing) ;
5. not all pathogens can be cultured ;
6. microscopic identification difficult ;
7. viruses difficult to identify ;
8. AV ; e.g. ref. specificity / ref. non-pathogenic diseases

[3 max]

[Total: 15]

CHEMISTRY ONLINE
— TUITION —

- 3 (a)
1. *idea of* wait for / time needed for, immune response to occur ;
 2. ref. B lymphocytes mature to, plasma cells / effector B cells ;
 3. plasma / effector B, cells secrete antibodies ;
 4. plasma / effector B, cells extracted from (mouse) spleen ;
 5. fused with, myeloma / cancerous / malignant, cells ;
 6. (hybridoma cells) cultured ; **A** *before or after mp7*
 7. identify cells secreting antibody (specific / against *T. pallidum*); *ignore 'containing'*
 8. AV ; e.g. use of fusogen [4 max]
- (b)
1. (solution of) H9-1 / antibody added ; *ignore injecting*
 2. given time for binding (then washed off) ;
 3. examined with microscope ;
 4. using, UV light ; **A** laser
 5. fluorescent / yellow, treponemes are *T. pallidum* ; [3 max]
- (c) *dark-field microscopy*
1. not enough treponemes (*T.pallidum*) present ;
 2. (*idea of*) not noticed among other treponemes ;
- blood test*
3. not enough antibodies present to measure (in plasma) ; *ignore absent*
 4. in host cells but not in blood / takes time to reach blood stream from point of entry ;
 5. ref. time for immune response to occur / immunocompromised people ; [2 max]

- (d) (
1. H9-1, more accurate than other tests / correct in all cases ;
 2. small number of false results from other tests ;
 3. blood test least accurate ;
 4. comparative figures ; (dark-field microscopy v. blood test)

e.g. of acceptable figures

(dark-field microscopy) 1 false negative and 2 false positives / ~ 5% / 3 errors out of 61 / 3.33% false negatives

(blood test) 3 false negatives and 2 false positives / ~ 8% / 5 errors out of 61/ 10% false negatives

5. comment re: small numbers

[3 max]

- (ii) 1. had infection before / antibodies already present ;

2. (have antibodies to) other treponemes that share an antigen with *T. pallidum* ;

[1 max]

(e) *N.B. treatment not diagnosis*

1. *idea of* (monoclonal) recognise, specific antigen / cancer cell ;
2. (monoclonal) carries, drug / radioactive molecule / coloured molecule ;
ignore magic bullet alone
3. how this leads to treatment ; e.g. *cytotoxicity / effect radiation / effect laser*
4. as passive vaccine ;
5. (monoclonal) injected directly into, blood / body, to attack a particular pathogen ; [2 max]

[Total: 15]

CHEMISTRY ONLINE
— TUITION —

- 4 (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]

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

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

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

[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]