

1. (a) Antibody binds/eq/recognises only to cancer cells;  
because of antibody-antigen binding/eg;  
enzyme activates the drug;  
at cancer cells only; max 3
- (b) B lymphocytes produce antibodies/involved in humoral response;  
T lymphocytes involved in cell mediated immunity;  
Macrophages present antigens;  
(specific) B lymphocytes recognise/bind to antigen;  
increase in numbers by mitosis;  
produce plasma cells (which make antibodies);  
antibodies bind to and clump/ agglutinate virus;  
memory cells produced by 1<sup>st</sup> exposure/cloned on 2<sup>nd</sup> exposure;  
T lymphocytes(helpers) produce lymphokines/chemicals;  
which aid B lymphocyte cloning;  
encourages phagocytes to engulf clumped virus;  
killer T cells kill virus infected cells; max. 6
- (c) Process of killing organisms might not be 100% efficient;  
live organisms might give rise to full-blown disease;  
attenuated organisms are non-virulent;  
but might mutate to virulent forms;  
immunity can decline - booster injections required;  
named side effects, eg allergies;  
less effective due to changed antigens; max. 3
- [12]**
2. (a) Formation of vesicle / phagocytosis;  
Derived from plasma membrane / eq; 2
- (b) (i) Lyosome; 1
- (ii) Contain hydrolytic enzymes;  
To break down / digest bacterium; 2
- [5]**
3. (a) Weakened organism; 1
- (b) On further exposure to same microorganism;  
Antigen recognised;  
Faster response;  
Greater production of antibodies; max 3
- (c) Number of reported cases falls after vaccination introduced;  
Because fewer individuals are vulnerable / less people to infect /  
more people immune; 2

(d) There was a reduction in number of new individuals being vaccinated / vaccine uptake was lower / higher number of babies; 1

[7]

4. (a) A molecule which stimulates an immune response / antibody production / surface protein / glycoprotein / non-self protein; 1

(b) (i) Plasma cells; 1

(ii) Memory (B) cells; 1

(c) Carried (an immunological) memory of the specific antigen; Produces large amounts of plasma cells quickly if the same antigen is encountered a second time; Rapid production of antibodies; *Not just 'bigger immune response'* 2 max

(d) 3 max

Measles	Influenza
One antigen/ unchanging	Several antigens/ changing
One type of memory cell/ antibody needed;	Several types of memory cell/ antibodies needed;

[8]

5. (a)

✓	x	;
✓	✓	;
x	✓	;
✓	x	;

4

(b) (i) (Females vaccinated) before pregnancy / so baby not damaged / does not get *Rubella*; *Reject immune / antibodies idea above*

(ii) Males vaccinated **so not a source of infection** for unprotected **females** 2

[6]

6. (a) Protein / glycoprotein / molecule on surface of virus;  
Stimulates immune response / antibody production; 2
- (b) Greater / more rapid production of antibodies following second vaccination;  
First encounter takes time for B cells to become activated / clonal selection process / time delay before antibodies can be produced;  
Memory cells present as result of first vaccination; 3
- [5]**
7. (a) uses / breaks up / digests host nuclear / genetic material (*allow references made to DNA /RNA instead of nuclear /genetic*);  
virus DNA / genetic material inserted into hosts DNA / chromosome / genetic material;  
host cells amino acids are used to synthesize viral proteins;  
cell lysis;  
by enzyme (produced by expressing a virus gene);  
toxin production; 3 max
- (b) (shape of) virus fits / binds / attaches to receptors / proteins in the cell membrane (of host); 1
- (c) antigen / protein structure / shape changed by heat;  
(*do not allow virus is killed/ destroyed or virus /antigen is denatured*) 1
- (d) one type of antigen / protein / shape / one strain of virus;  
(*allow virus does not mutate or virus does not change*)  
same immune response generated; 2
- [7]**
8. (a) Bacterium (always found) in diseased organism and not in healthy organism;  
Bacterium (can be) cultivated / cultured / isolated;  
(Pure) cultures of the bacterium must cause the same disease / symptoms when introduced into (susceptible) other organisms;  
Can be re-isolated (from the other experimentally infected animals); 4
- (b) Spread by droplet infection / breathed in / airborne; 1
- (c) (i) Numbers falling before vaccination introduced; 1

- (ii) Better housing conditions / other social reason e.g. diet;  
 Better awareness of disease / improved medical care;  
 Fewer susceptible people / more immune;  
 Availability of antibiotics post circa 1940; (*reject before*)  
*Reject 'hygiene'* 1 max

[7]

*allow virus does not mutate or virus does not change*  
 same immune response generated; 2

[7]

9. (a) (i) A disease-causing organism / bacterium; 1

(ii) Weakened organism; 1

(a) (At 95% level) most people are immune;  
 5% / few vulnerable / susceptible individuals (remain in  
 population); *Reject 'not immune'*  
 Little chance of contact (with affected person); 2 max

(c) (i) Number of births each year varies / changes seen more easily /  
 allow valid comparisons to be made / provides an indication of  
 likelihood of outbreak of disease; 1

(ii) 3600; 1

(d) Antibodies not produced by body;  
 No memory cells;  
 Short-term / not lifelong;  
Antibodies (*or context established*) donated by mother /  
 across placenta / in milk; 2 max

[8]

10. (a) (i) Molecule/part of molecule/protein/glycoprotein;  
 [*Allow: polysaccharide*]  
 Stimulates immune response; 2

(ii) These antigens/antibodies have complementary/particular shape;  
 [*Reject: Active site*]  
 Allow fitting/binding with (relevant) antibody/antigen; 2

(b) Calichaemicin delivered specifically to cancer cells/less likely to/will

not harm normal/healthy cells;  
Lower dose of calichaemicin needed to be effective; 2

[6]

11. (a) molecule (on cell surface);  
that triggers immune response; 2

(b) (i) axes right way round and labelled;  
2nd peak drawn higher;  
steeper gradient on second rise; 3

(ii) because one dose does not give a high enough level of antibody to  
be effective/ because the antibody falls after a while; 1

(iii) antigens are only single molecules/part of parasite;  
do not actually cause disease; 2

(c) malaria sufferers would have parasites in red blood cells; 1

[9]

12. (a) add antibodies/enzyme;  
wash to remove unbound antibodies;  
add (colourless) solution; 3

*(mark correct responses sequentially)*

(b) antibodies specific/shape only fits one antigen;  
other antigens different shape;  
would not bind to antibodies; 2 max

[5]

13. (a) (i) protein/immunoglobulin;  
specific to antigen;  
idea of "fit"/complementary shape; 2 max

(ii) 1. virus contains antigen;  
2. virus engulfed by phagocyte/macrophage;  
3. presents antigen to B-cell;  
4. memory cells/B-cell becomes activated;  
5. (divides to) form clones;  
6. by mitosis;  
7. plasma cells produce antibodies;  
8. antibodies specific to antigen;  
9. correct reference to T-cells/ cytokines; 6 max

- (b) 1. antibody gene located using gene probe;  
 2. cut using restriction enzyme;  
 3. at specific base pairs;  
 4. leaving sticky ends/unpaired bases;  
 5. cut maize/DNA /vector using same restriction enzyme;  
 6. join using DNA ligase;  
 7. introduce vector into maize/crop/recombinant DNA into maize; 4 max

- (c) passive;  
 person is not making own antibodies/antibodies not replaced;  
 memory cells not produced; 2 max

- (d) fewer ethical difficulties/less risk of infection; 1

[15]

14. (a) Stimulates memory cells;  
 Secondary response;  
 Antivenom / antibodies produced quicker; max 2

- (b) Passive immunity;  
 No memory cells produced;  
 Antivenom breaks down / destroyed; max 2

- (c) Could transfer disease/Allergy/Immune response to antibodies from animal; 1

[5]

15. (a) 47 213; 1

- (b) (i) there is no difference in the proportion / number of influenza cases  
 between the 5 vaccines;  
*(reject vaccinated versus no vaccinated)* 1

- (ii) significant difference in proportion / number of cases of influenza  
 between the vaccines / the null hypothesis should be rejected; 1

- (c) sample size small;  
 possible differences in exposure to infection;  
 exposure to different strains / mutants;  
 possible differences in existing immunity;  
 possible differences in sex / age;  
 possible differences in socio-economic status; 2 max

[5]

16. (a) (i) Amino acids; 1  
 (ii) Peptide; 1
- (b) Contains specific sequence of amino acids;  
 Complimentary shape enables attachment to antigen; 2
- (c) (Maternal antibodies) are antigens;  
 Destroyed by (fetal) antibodies / lymphocytes; 2

*Q Do not credit marks where source of antigens or antibodies/lymphocytes is ambiguous.*

[6]