

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 1st exposure/cloned on 2nd 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
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
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

[5]

[7]

- (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]