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^{st} exposure/cloned on 2^{nd} 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) 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]

6. (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]

7. (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]

8. Quality of Written Communication

Answers to part (e) of this question require continuous prose. Quality of written communication should be considered in crediting points in the marking scheme. In order to gain credit, answers must be expressed logically in clear, scientific terms.

(a) (i) Injected with water/saline/something that did not include antigen; 1

(ii) Results could be compared with control group/
to make sure that nothing else in the treatment produced the results; 1

(b) Allows a comparison to be made;
as different numbers of people might have been treated; 2

(c) (i) Largest difference between the vaccinated and control group; 1

(ii) They have not been exposed as much to malaria/fewer have had malaria;
no natural immunity; 2

(d) B-lymphocytes respond to specific antigen;
divide rapidly/clone produced;
form plasma cells;
plasma cells secrete antibodies;
some form memory cells which become active on second exposure to antigen;
produce antibodies faster Max 5

[12]

9. (a) large variety of different molecules;
range of shapes;

OR

tertiary shape;
locks onto / complements specific antigen; 2

(b) pathogenicity / toxicity of products;
site of infection;
invasiveness; max.2

(c) (i) 5 hrs or more; 1

(ii) small vols. / water must be clear /
full sunlight needed if water required quickly / shortage of containers; 1

(d) larger concentration of bacteria in food / bacteria need nutrients in 'food'; 1

[7]

10. (a) amino acid; 1

(b) X at the end of either or both light chains; 1

(c) <u>shape</u> of antigen fits / binds / attaches / complementary to (shape of)
antibody; (*ignore references to active site*) 1

(d) allows antibody to lock onto / (easily) make contact with antigen;
more likely / able to make contact
with 2 / more than 1 (identical) antigens; 1 max

[4]

11. (a) 1 macrophages present antigens to B lymphocytes;
2 antigen binds to/is complementary to receptors on lymphocyte;
3 binds to a specific lymphocyte;
4 lymphocytes become competent/sensitised;
5 (B) lymphocytes reproduce by mitosis /(B) lymphocytes cloned;
6 plasma cells secrete antibodies; 4 max

(b) 1 restriction enzyme/endonuclease;
2 to cut plasmid/to form sticky ends in plasmid;
3 (use) ligase(to join) gene to plasmid;
4 culture bacteria with(in medium containing) plasmids
5 to allow uptake of plasmids / transformation;
6 use of cold shock/chemical treatment(to enhance uptake)/ heat shock;
(ignore bullets/electroporation /microinjection) 3 max

[7]