AQA

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme January 2003

GCE

Biology B

Unit BYB7

Section A

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Unit 7: Microbes and Disease

Question 1

(a) cell wall;
capsule; 2

(b) 130 000 / 6.5;
20 000; (*Allow 1 mark for using 6.5 as the denominator*) 2

(c) membranes (folded to increase the surface area);
(allow references to phospholipid bilayers – do not award references to cell membranes)
(sites) for respiration / electron transport chain;
contain electron carriers / cytochromes / enzymes;
(do not allow references to glycolysis, Krebs cycle) 2 max

Total 6

Question 2

(a) correct dilution step (for example, add 1cm^3 to 9cm^3 for a 1 in 10 dilution or 1cm^3 to 99cm^3 for a 1 in 100 dilution);
repeat dilutions to achieve 1 in 1000;
(allow maximum 1 mark if correct volumes are used to achieve 1 in 1000 dilution in a single step)
using sterile water / named sterile technique / mix; 3 max

(b) (i) colony / offspring from a single bacterium / growth of bacteria; 1

(ii) 14 × 100 000 = 1 400 000;
×10;

(allow 14 000 000 / 1.4 × 10^7 for 2 marks); 2

(c) extra dilution introduces additional error / not mixed thoroughly; 1

(d) includes dead cells / a total count; 1

Total 8

Question 3

(a) enzyme is more stable / active / not denatured over a wider range of pH values / temperatures;
sweeter milk not contaminated by / easily separated from enzyme;
enzyme is reusable / not lost; 2 max

(b) larger surface area of beads;
(disallow this mark if the enzyme acts on the surface of beads)
more chance of enzyme substrate collisions; 1 max

(c) chromatography;
two spots on chromatography paper / no spot for lactose / no spot with Rf value equivalent to lactose;

or details of a quantitative benedicts test / a glucose biosensor / clinistix strips (for glucose);
(do not award a mark for biosensor unless the sugar detected by it is stated);
suitable end-point (for example, no additional precipitate is formed / no further increase in glucose levels); 2 max

Total 5

Question 4

(a) phagocytosis / engulf and digest *(allow ingest, destroy, inactivate)*;
antigen presenting; 2

(b) receptors in hypothalamus detect change in body temperature; *(reference to hypothalamus is sufficient)*
impulses travel along neurons / nerves;

one of
to (muscles of) arterioles;
causing vasoconstriction / contraction of muscles / less blood to flow into surface capillaries;
less heat is lost from the body;

or causing shivering / rapid contraction of skeletal muscles;
with increased rate of respiration / metabolism;
generating (extra) heat;

or release of thyroxine / adrenalin;
with increased rate of respiration / metabolism;
generating (extra) heat;

or reduced / no sweating;
less / no evaporation;
less heat is lost from the body;

or hairs stand erect;
trapping insulating warm air;
less heat is lost from the body; 4 max

Total 6

Question 5

(a) amino acid; 1

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

(c) shape 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

Total 4

Question 6

(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

(e) *Award a mark for damage caused to an organ only if it is accompanied by a valid explanation about the effect of the damage.*

damage to the pancreas;
lack of / no insulin (produced);

damage to liver;
insulin no longer affects (liver) cells / does not bind to receptors / does not work / cells are impermeable to glucose;

damage to kidneys;
no / less active transport of glucose (across tubule cells) / membrane bound channel proteins destroyed;

less / no blood glucose converted to glycogen / taken into liver;
kidneys unable to reabsorb (all) glucose; 4 max

Total 11

Question 7

(a) infectivity is measured by the number of bacteria required to cause disease (symptoms) / infection;
small numbers needed for *S typhi*;
invasiveness is measured by the spread of the pathogen / bacterium / *typhi* / toxin through the body;
S typhi spreads widely (from the point of infection) / in blood / tissue fluid; 3 max

(b) bacteria present in faeces;
contaminate food / drinking water / people by shaking hands;
others are infected by consuming (inadequately cooked) food / drinking water / fingers put in mouth; 3

(c) for the principle that chloramphenicol could be a competitive / non-competitive inhibitor;
details about the mode of inhibition (competition with a substrate for the active site / changed shape of active site so substrate does not fit);
translation (is affected);
effect on the role of tRNA *(allow tRNA does not bind / not attracted to ribosome)*;
effect on the role of mRNA *(allow mRNA does not bind to ribosome / tRNA)*;
peptide bonds do not form;
amino acids do not join;
4 max

Total 10