Mark scheme
June 2002

GCE

Biology A / Human Biology

Unit BYA3

Question 1

(a)   Organism that lives in / on another organism / host and which
is living / causing it harm;   **1**

(b)   Human / named location in human
(Fresh) water *reject 'marine'*
Snail
Human / named location in human
All 4 correct = 2 marks
Any 3 correct = 1 mark   **2**

(c)   Any 3 of:
'Suckers' (*or reasonable description in context*) for attachment / so not dislodged
(from blood vessel);
Absence of locomotory organelles in underlined adult since remain in blood
vessel / other valid explanation;
(Digestive) enzymes to rupture blood vessel / burrow through skin;
Large number of eggs to increase chance of finding secondary
host / snail / complete lifecycle;
Ciliated cercariae to swim through water;
Large number of cercariae to increase chance of finding
main host / human;
Surface proteins / resistant layer to prevent attack by
host / prevent digestion;
Use of intermediate host to complete life cycle;   **3 max**

Total 6 marks

Question 2

(a)   (i)   **A** / identified (e.g. 7):
has ½ mass of DNA in B / ¼ mass of DNA in C / would have ½
chromosome number of B / contains least DNA / has 23 chromosomes;   **1**
Reject haploid

(ii) 14 (arbitrary units);
Diploid number of chromosomes re-established;
Gametes are haploid (*or concept explained*) / each gamete will contain
7 units;   **2 max**

(b)   Separation of chromatid pairs / chromatids within a pair / chromosomes;
Reject 'homologous chromosomes'   **1**

Total 4 marks

Question 3

(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 <u>before vaccination</u> 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*)   **1 max**
Reject 'hygiene'

(d)   HIV affects <u>cells</u> of immunological system / white blood <u>cells</u> /
lack of functional white blood <u>cells</u> / eq (means a person is more
susceptible);   **1**
Reject 'affects immune system'

                                     Total 8 marks

Question 4

(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 <u>contact</u> (with affected person);   **2 max**

(c)   (i)   Number of <u>births</u> 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;
<u>Antibodies</u> (*or context established*) donated by mother /
across placenta / in milk;   **2 max**

                                     Total 8 marks

Question 5

(a)   (i)   Enzymes and (colourless) dye; *ignore wrong names of enzymes*   **1**

       (ii)   Glucose oxidase;
             Peroxidase; *accept 'peroxide reductase'*   **2**

       (iii) Enzymes are specific / glucose oxidase only reacts with glucose /
             Peroxidase only reacts with hydrogen peroxide
                   OR
             A $\rightarrow$ H_2O_2 and B $\rightarrow$ colour change;   **1**

(b)   No glucose <u>in urine</u> / person not diabetic / concentration
             normal in blood   **1**

(c)   Enzyme-based method is quantitative / more sensitive /
             specific to glucose / ora;   **1**

                                   Total 6 marks

Question 6

(a)   Lower blood pressure / less turbulence (in veins);   **1**
             Reject 'no pressure'.

(b)   (Collagen in) damaged blood vessel wall / platelets;
             (Activates) thrombokinase / thromboplastin;
             In presence of calcium (ions) / plasma enzymes / factor 8;
             Prothrombin converted to thrombin;
             (Thrombin causes) conversion of fibrinogen into fibrin;   **4 max**
             Latter two must be in correct sequence for both marks.

(c)   (i)   (Greater blood) turbulence;   **1**

       (ii)   Arrow at point of branch or just below in coronary <u>artery</u>;   **1**
             Reject 'above branch'.

                                   Total 7 marks

Question 7

(a)   *Penicillium* / fungus produces / secretes antibiotic / penicillin;
       Penicillin (*reject Penicillium)* / antibiotic will kill / inhibit the growth
       of bacteria / other microorganisms;   **2**

(b)   Reduce rate of (population) growth / slow division of bacteria /
       cells / reduced metabolism;
       So nutrient supplies not exhausted / toxins not accumulating;   **2**

(c)   (mRNA) cannot be translated / translation cannot occur;
       Peptide bonds are not formed / amino acids cannot join /
       polypeptide not formed;
       No codon-anticodon binding;   **2 max**

                                                              Total 6 marks

Question 8

(a)   Identify those at risk from <u>developing</u> cancer;
So as to avoid relevant environmental factors / enable early diagnosis;
Identify risk in families;   **2 max**

(b)   *Mutation of suppressor gene – up to 4 marks*

    1. Mutation is a change in the DNA / sense strand;
    2. Base sequence altered / e.g.;
    3. Suppressor gene produces wrong instructions / has different code;
    4. (Therefore) different amino acid sequence;
    5. Different protein structure / non-functional protein;

    Malignant tumour – up to 2 marks

    6. Cell division by mitosis;
    7. Tumour cells growth abnormal / continuous / uncontrolled / rapid;
    8. Tumour cells spread / invade other tissues / form secondary
        tumours / metastasis;
    9. Via blood / lymph system;   **6 max**

(c)   (i)   Most lung cancer occurs in smokers / non-smokers also
develop lung cancer;
Smoking increases the risk of lung cancer;
Smoking is an environmental factor for lung cancer;
Smokers' risk more than 4x that of non-smokers / correct ref to figures;
(But) only a small proportion of smokers develop lung cancer;
Smokers more likely to develop other lung disease than cancer; **3 max**

    (ii)   Do not know size of sample / might be small sample in study;
Genetic differences / predisposition;
Could be different age at which started to smoke;
Could be different number of cigarettes smoked per day;
Could be different tar levels in cigarettes smoked;
Could be different sexes in sample;
Other valid;   **2 max**

(d)   All exposed to same environmental conditions / factors / no
regional variations;
Same level of pollution / example; *reject less pollution*
Similar diet / example;
Same water supply;
Easier to screen whole population;
Easier to follow family history / people related;
Identify genetic differences in those affected (since everything
else the same) / less genetic diversity;   **2 max**

Total 15 marks

Question 9

(a)   Carrier of foreign DNA / gene;   **1**

(b)   (i)   *Pst* I;   **1**

       (ii)   (Loss of) marker gene;
              Genetic code / base sequence / DNA altered;
              (So) gene no longer functional;   **2 max**

       (iii) Separate DNA strands to expose sense strand / probe only a
              single strand;
              Probe contains a complementary base sequence to gene;
              Attaches to complementary sequence if gene present;
              Presence / location indicated by radioactivity / fluorescence;   **3 max**

(c)   So cells cannot conjugate / link;
             To stop transfer of DNA;
             To reduce risk of other organisms in environment getting altered genes; **2 max**

(d)   1. DNA is double stranded / double helix;
             2. Unwinds / separates / hydrogen bonds break;
             3. Two strands / sense / antisense strands exposed / act as templates;
             4. DNA nucleotides in nucleoplasm / link together / form polynucleotide;
             5. Complementary base pairing / described;
             6. Role of DNA polymerase;
             7. Two identical copies of DNA made;
             8. Each contains one of original strands / semi-conservative;   **6 max**

                                                              Total 15 marks