Mark scheme
January 2002

GCE

Biology B

Unit BYB4

SECTION A

Question 1

(a)   A = rods AND B = cones;   1

(b)   Fovea centralis / fovea / yellow spot;   1

(c)   more receptor cells at **8** / fewer receptor cells at **12 OR**
            cones present in **8** / cones not present in **12**;
            cones capable of greater acuity (than rods);
            because each cone has / is more likely (than rods) to have its own
            ganglion / bipolar cell / nervous supply;   2 max

                                                                    Total   4

Question 2

(a)   (i)   Centromere;   1
       (ii)   Attaches (chromatids / chromosomes) to spindle (in
              cell division) **OR** divides to separate chromatids;   1

(b)   Chromatids;   1

(c)   Haploid, because no homologous / paired chromosomes present /
             allow "because all the chromosomes are different";   1

                                                                    Total   4

Question 3

(a)   (i)   (Kidneys) *function*: removes urea from blood, *evidence from
              graph*: when kidneys not working the level of (blood) urea rises;   1

       (ii)   (Liver) *function*: makes urea / adds urea to blood, *evidence from
              graph*: no rise in urea (when liver not working) **OR** when working,
              urea not removed, so level rises;   1

(b)   *Shown on graph. Firstly need to demonstrate change in gradient
             at 12 hours.*
             Time 0 to 12 hours – steady decline in urea level (below line Q);
             Curve horizontal from 12 hours;   2
             *Still award full credit if the line falls to x axis within first 12 hours
             and remains on the x axis thereafter.*

                                                                    Total   4

Question 4

(a)   Condominance;   1
          (*Allow* incomplete / inheritance without dominance)

(b) $X^B Y$ **OR** B(-);   1

(c)   *Parental genotypes are given:* $X^R X^R$ $(X^B Y)$ - no mark

          Offspring 1 genotypes: $X^R X^B$ $X^R Y$;

          Offspring 2 genotypes: $X^R X^R$ $X^R X^B$ $X^R Y$ $X^B Y$;

          Offspring 2 phenotypes: round eyed wide-bar round eye bar-eye
                                         female   female   male   male   ;   3

          Ratio: 1   :   1   :   1   :   1

          (*Ignore ratio unless it contradicts: be alive to other possible ratios*)
          (*No marks as such for "gametes", though may inform markers
           where unclear.*)

                                                                                Total   5

Question 5

(a)   (Radioactive) carbon dioxide is used / incorporated;
              New compound(s) / intermediate(s) / names egs formed /
              become labelled;   2

(b)   (i)   Because stops reaction(s)/ process / pathway / enzyme action /
              kills algal cells;   1

       (ii)   Because reactions occur quickly
              OR need to remove samples after short / precise time;   1

(c)   Q   →   R   →   S   →   P   ;   1

(d)   Idea of cycle (or equivalent);
              Compound Q is used / reformed;   2
              *If either above present allow identification of possible Q as: G3P /
              PGA / triose phosphate / GALP / RuBP*
              Any two from three (noting special arrangement re. third point)

                                                                                Total   7

Question 6

(a)   Phylum,
        Order,
        Genus;
        Any 2 score 1, all three gain 2 marks

(b)   F. serratus and F. spiralis;
        Highest % value (for non-self);
        The more closely related they are, the more similar their DNA;
        Explanation of value / complementarity in terms of joining strands;   3 max
        (*Special case: if spiralis / spiralis given, then max 1 possible if
        complementarity explained*)

                                                                Total   5

Question 7

(a)   Reduced light intensity;
        Receptors identified as in retina / rods / cones;
        Nerve impulses to CNS / along sensory nerve;
        Nerve impulses from CNS / motor;
        <u>Sympathetic</u> action;
        To <u>radial</u> muscles which contract;   3 max

(b) (i)   Prevents parasympathetic NS from working
           OR allows sympathetic nervous system to work unopposed;   1

     (ii) Eserine (no mark itself) involves acetylcholine;
           Inhibits enzyme which normally breaks down Ach **OR** stops it
           being broken down;
           Effect of Ach / parasympathetic effect not stopped / enhanced e.g.
           "AcH continues to bind to receptors" or similar;   2 max

                                                                Total   6

Question 8

(a)   <u>Carbohydrate / named example</u> from food / diet / gut;   1

(b)   (i)   Pancreas;   1

       (ii)   (*1 for each hormone correct / per column*)

Effect of hormone	Insulin	Glucagon
Reduces carbohydrate in reservoir D		✓
Promotes A – fat breakdown	✓	
Promotes C – protein breakdown		✓
Increases rate of outflow at E	✓	

                                                                          2

(c)   (i)   Glycogen;   1

       (ii)   Fats / lipid / triglyceride / adipose;   1

(d)   (Adrenaline) D;
             (Thyroxine) E;   2

                                                    Total   8

Question 9

(a)   The higher the altitude, the lower the frequency (or converse);
             Below 400m altitude, frequency levels off / pretty constant;   2

(b)   (*Higher frequencies found at certain (low) altitudes because*)
             Malaria found mainly among people at low altitudes;
             Because warmer here **OR** more sources of still / slow-moving water;
             t allele / heterozygous condition confers some resistance
             against malaria;
             Selection operates / heterozygotes favoured over
             homozygous (dominant);   3 max

(c)   Mainland Italians didn't bring / import the t allele with them
             OR hadn't been exposed previously to malaria;
             Malaria not / less of a factor in Sardinia since Carloforte established;
             Insufficient time / generations for selection to operate / have an effect;   2 max

                                                    Total   7

SECTION B

Question 10

(a)   Needed to make ATP / for phosphorylation;   1

(b)   (Oxygen) needed for formation of ATP / phosphorylation;
              (Oxygen) used (so its level falls);
              (Oxygen) reacts (with 'H') to produce water;
              In the electron transport chain / at terminal acceptor;
              Allows recycling of reduced coenzymes / NAD / FAD;   3 max

(c)   Because equal amounts of ADP were added;   1

(d)   Less oxygen available in medium at Z than at Y
              OR because oxygen all used up / 'runs out';   1

(e)   (i)   Glucose cannot enter mitochondria BECAUSE too large to enter /
              no carrier system for it;
              OR glucose cannot be metabolised / equivalent BECAUSE necessary
              enzymes not present;   2
              (*Note single marks here for a suitable suggestion, and for a
              connected, plausible reason / also that suggestion and reasons
              may 'cross over'. Allow, each for 2:* "no cytoplasm, no glycosis,
              not to pyruvate")

       (ii)   Label glucose and determine its failure to enter mitochondria;
              'Break' mitochondrial membrane (to allow entry of glucose);
              'Release' appropriate enzymes from mitochondrion;
              Add glycolytic enzymes / 'cytoplasm' to medium in advance;
              (**OR** suitable suggestions re. possible reason previously given)   1
(f)   Structure of sarcomere explained re. chains of sarcomeres in fibres;
              Actin – thin filaments, myosin – thick filaments;
              Relating sarcomere structure to thin / thick filaments
              OR acting / myosin;
              Idea of sliding filament hypothesis;
              Cross bridges formed between actin and myosin;
              ATP to ADP releasing energy;
              ATP / energy required for detachment / re-attachment;
              Explanation of ratchet mechanism;
              Need for Ca^{++} to move tropomyosin out of way / change its shape;
              Movement of tropomyosin allows attachment;
              Need for Ca^{++} in splitting of ATP;   6 max
              (*Note that answers may use annotated diagrams*)

                                                          Total   15

Question 11

(a)   (Gene 1) allele A makes <u>enzyme</u> converting J to K / colourless to red;
            Allele a produces no / non-functional <u>enzyme;</u>
            (Gene 2) allele B makes <u>enzyme</u> converting K to L / red to purple;
            Allele b produces no / non-functional <u>enzyme;</u>
            ("Recessive alleles produce no / non-functional enzyme" = 2)
            White flowers result from genotype aa;
            … regardless if B or b / even if aaB_ ;
            Colourless (substance) / J produces white;
            Red flowers when A_bb / enzyme 1 only;
            Purple flowers when A_B_ / enzymes 1 and 2;   6 max

(b)   (i)   (1) (red parent) AAbb;
            (2) (white parent) aaBB;   2

      (ii) F_1 are AaBb;
            F_2 ratio of 9 : 3 : 4;
            Purple : red : white;
            Suitable working shown;   4

(c)   (i)   aabb, aaBb, and aaBB; (allow aabb & aaB_)   1

      (ii) (Crush each type of white petal to make an extract, and)
            add some of the (red) pigment / K, to petal **OR** incubate with K;
            (extract becoming) purple is identified as aaBB **OR** that staying red,
            after K is added, is aabb;   2

                                                            Total   15

                    Quality of written communication   1