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

[4]

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

[4]

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 marks

4. (a) Codominance;
(*Allow* incomplete / inheritance without dominance) 1

(b) X^BY **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 female; wide-bar female; round eye male; bar-eye 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.)

[5]

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;
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) 2

[7]

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)

[5]

7. (a) Reduced light intensity;
Receptors identified as in retina / rods / cones;
Nerve impulses to CNS / along sensory nerve;
Nerve impulses from CNS / motor;
Sympathetic action;
To radial 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

[6]

8. (a) Carbohydrate / named example from food / diet / gut; 1

(b) (i) Pancreas; 1

(ii) (*1 for each hormone correct / per column*) 2

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

(c) (i) Glycogen; 1

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

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

[8]

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

[7]

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)

[15]

11. (a) (Gene 1) allele A makes enzyme 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

[15]