BYB4 Energy, Control and Continuity

Question 1

(a) A = suspensory ligaments;
B = ciliary muscles / body; 2

(b) (i) ciliary muscles / B relax;
suspensory ligaments / A become taut / are pulled;
lens refracting / converging / `bending' power reduced; 3

(ii) refraction (by cornea) reduced;
focused / image on retina / fovea; 2

Total 7

Question 2

(a) greater environmental influence than genetic; 1

(b) identical twins have same genotype / converse for non-identical;
compare identical and non-identical twins / identical twins who have been separated / non-identical twins in same environment;
if genetic - similarity between identical twins / converse;
large sample required / use a statistical test; 4

Total 5

Question 3

(a) phylum, class, order;
species, *Acinonyx jubatus;* *2*

(b) larger groups containing smaller groups; 1
(ii) fossil record;

(c) (i) do not interbreed to produce fertile offspring / different DNA /
different niches; 1

evolutionary history/phylogeny;
biochemical differences e.g. DNA/proteins/cytochromes;
homologous features / named feature;
karyotype / number and form of chromosomes; 2
(discount any example credited in (i))

Total 6

Question 4

(a) (i) TB Tb tB tb; 1 (ii) homologous chromosomes appropriately labelled; 1 (iii) separation of chomatids; 1

(b) (i) crossing over occurs;
between D and G;
sections of chromatids/chromosomes/DNA/genes exchanged; 3

(ii) crossing over is infrequent (between close genes); 1 **Total** 7

Question 5

(a) e.g. urea / amino acids / fatty acids / glycerol / ion / small protein; 1
(one mark for two of above)

(b) blood pressure decreased;
(less pressure) forms less filtrate; 2

(c) microvilli provide large surface area;
carrier proteins (in membrane) for active transport;
channel proteins for facilitated diffusion;
specific carriers for specific molecules / sodium pumps;
(many) mitochondria for active transport; 2 max

(d) (i) up to 2.2 mg $_{CM\ -3}$ all glucose reabsorbed / above 2.2 mg cm^{3} excess glucose not reabsorbed / at 2.2 mg cm^{3} threshold value reached;
saturation of carriers / active transport mechanism; 2

(ii) decrease in insulin production / receptors not responsive to insulin / specific damage to tubule described / membrane less permeable to glucose; 1

Total 8

Question 6

(a) is always expressed (in the phenotype) / produces (functional) proteins; 1 (b) codominance; 1

(c) *Parental genotypes* - $hhC^{R}C^{W}$, $HhC^{w}C^{W}$;

Gametes -

Offspring genotypes - $HhC^{R}C^{W}$, $hhC^{R}C^{W}$, $HhC^{W}C^{W}$, $hhC^{W}C^{W}$;
Offspring phenotypes - hornless homed hornless homed roan roan white white
Ratio of offspring - *1 1 1 1;*

(d) (i) sperm (with more DNA) have X chromosome;
X is larger / has more genes than Y; 2

(ii) female for milk / males for meat / male or female for breeding; 1

Total 9

Question 7

(a) *x ;*
x x 1';
.i '7 ,/;
I/ x x; 4

(b) (i) pyruvate/succinate/any suitable Krebs cycle substrate; 1

(ii) ADP and phosphate forms ATP;
oxygen used to form water / as the terminal acceptor; 2

(iii) Y X W Z;
order of carriers linked to sequence of reduction / reduced carriers cannot pass on electrons when inhibited; 2

Total 9

Question 8

(a) (i) maintaining a constant internal environment; 1

(ii) *one mark for example of factor kept constant; one mark for explaining its importance;*

e.g.
temperature / pH;
optimum for enzymes / effect of pH / temperature on enzyme activity;

OR

water potential / blood glucose;
effect of osmotic / blood glucose imbalance on cells; 2 max

(b) (i)
1. hypothalamus (contains the thermoregulatory centre);
2. has receptors which detect temperature changes of blood;
3. receives impulses from receptors in skin;
4. nerve impulses transmitted (from hypothalamus / brain);
5. results in vasoconstriction / constriction of arterioles / dilation of shunt vessels;
6. diversion of blood to core / specified organ / less blood to skin;
7. muscular contraction /shivering generates heat via respiration;
8. release of thyroxine / adrenaline;
9. increase in metabolic rate / respiration;
10. correct reference to negative feedback mechanisms; 7 max

(ii) larger surface area to volume ratio;
less insulation / steeper thermal gradient;
more heat loss by conduction; 2 max

(c) cannot interact with / move tropomyosin;
(allow troponin)
from binding sites on actin;
(reject active sites)
myosin (heads) do not bind / actinomyosin not formed;
does not activate ATPase / energy not released from ATP; 3 max

Total 15

Question 9

(a) action potential arrives / depolarisation occurs;
calcium ions enter synaptic knob;
vesicles fuse with membrane;
acetylcholine diffuses (across synaptic cleft);
binds to receptors; 4
max

(b) inside becomes more negatively charged / hyperpolarised;
stimulation does not reach threshold level / action potential not produced;
depolarisation does not occur / reduces effect of sodium ions entering; 3

(c) (i) inhibits enzyme (which breaks down GABA);
more GABA available (to inhibit neurone);

OR

binds to (GABA) receptors;
inhibits neuronal activity / chloride ions enter (neurone); 2
max

(ii) receptors have different tertiary/3D structure/shape not complementary;
GABA cannot bind;
inhibition of neuronal activity does not occur / chloride ions do not enter; 3

(d) motor area;
left cerebral hemisphere; 2

Total 14

QWC

1