1. (a) X = grana/lamellae/thylakoid (membranes);
Y = stroma; 2

(b) $NADPH_2$/ NADPH/ reduced NADP/reduced coenzyme;
ATP; 2

(c) carbon dioxide/CO_2; 1

(d) (i) stroma; NOT "Y" 1

(ii) production/breakdown of starch (or equivalent); 1

[7]

2. (a) *Oryctolagus, Helix, Trichonympha*; (reject if specific names included)
(not insisting on generic capitals) *any two for 1 mark* 1

(b) Animals, Protoctists, Prokaryotes;; (accept Latin equivalents)
any two for one mark, all three for both 2

(c) that (they are) fertile; 1

[4]

3. (a) *Mark across whole of two parts in (a) to credit the following possible points*

(structure)	*Distant object*	*Close object*
Cornea	– converges light/refracts/bends light;	
suspensory ligament	– in tension	– tension relaxed;
Ciliary Body	– relaxed;	– contracts;
Lens	– pulled thin;	– allowed to become fatter/more spherical;
	– the more convex/fatter the lens, the shorter focal length (or converse)	

Each itemised point in a box (-) worth one mark. Any 6 from 8 points.

(b) (i) only blue-(sensitive) cones/cells stimulated; 1

(ii) (mixture of) green - and red(-sensitive) cones/cells stimulated; 1

(c) value or range 575 to 600(nm) (accept any range within 551 to 649 nm); 1

(d) there are two phases/sections to the curve (or equivalent idea) OR
one cell type reaches full sensitivity before other; (ignore any 'cell' identification if wrong)

(e) rhodopsin was bleached/is resynthesised;
to/ from pigment/retinal;
and to/from protein/opsin;
any 2 from 3 2

[12]

4. (a) (acetylcholine) made in/stored in synaptic vesicles;
released into (synaptic) cleft;
diffuses/moves across (cleft);
binds to protein/receptor molecules on (postsynaptic) membrane/neurone;
causes depolarisation/action potential/new impulse (in postsynaptic neurone);
any 3 from 5 3

(b) to provide energy for the (re)synthesis of Ach OR associated active transport; 1

(c) receptor detects stimulus;
impulse to muscle
(escape response effected by muscle to withdraw head into burrow)
muscle (M) longitudinal OR when it contracts it pulls animal shorter;
no coordinator involved/only 3 neurones in reflex (arc);

reflex is 'automatic' (or equivalent point);
any 3 from 5 3

(d) (impulses) may cross synapses in one direction only/
transmitter may only travel one way; 1

(e) (i) axon P myelinated;
OR axon diameter of P greater (than that of other axons); 1

(ii) (increased speed of escape response)
increases the animal's chances of survival; 1

[10]

5. (a) D; 1

(b) Krebs cycle;electron transport/transfer chain/oxidative phosphorylation;
(glycolysis negates one point of credit)
(link reaction and glycogenesis etc. are 'neutral') 2

(c) some radioactivity in intermediates/other compounds (e.g. glucose);
ACCEPT idea of less present because of radioactive decay;NOT
because of 'rounding off' 1

(d) (1200 / 8000) × 100;
15 (%);
(allow (1800 / 8000) × 100 = 22.5% for 1 mark)
(2 marks for the correct answer as 15% without working,
1 mark for 22.5%)) 2

[6]

6. (a) sandy stated as heterozygous/suitable allusion to alleles;
suitable cross chosen;(as in table) N.B. *second two points linked, not stand-alone*
explained why could not be codominance;

N.B. Second two points linked, not stand alone

Suitable cross	*Reason why **not** codominance*
3 and 4	Offspring should all be sandy
10 and 11	Offspring should all be sandy
7 and 8	Offspring should all be red

BUT if candidate assumes sandy is homozygous, mark accordingly
e.g. "look at cross 1 and 2; all their offspring would be sandy;"
and not that, if red or white then identified as heterozygote,
then full 3 marks are still possible. 3

(b) 11 aabb,

10 = AaBb, (*N.B. only possibility, not A-B-*)
2 = A_bb or aa B- (or one possible genotype);;
if all 3 correct – 2 marks/ if 2 correct - 1 mark; one or fewer – 0 marks 2

(c) *1 mark for each element of clear explanation i.e.*
- choice of a suitable piece of evidence;
- explaining why Hypothesis 2 could not account for the observed result;
(only cross really possible is 1 and 2) i.e. if sandy was aaB_, individuals 1 and 2 would both have been aaB;so their offspring could only be either white or sandy (as no A alleles present); 2

(d) *(Mark line by line, not to 'first error': do not allow for consequential errors)*

Individual 18 *Other parent*

Parental genotypes **AaBb;** *No mark for this (AaBb)*

Parental gametes **AB Ab aB ab** *and* **Ab ab;**

Offspring genotypes

AABb	**Aabb**	**AaBb**	**Aabb**
AaBb	**Aabb**	**aaBb**	**aabb**

(Punnett not necessary

Offspring phenotypes **red** **sandy** **white**

Expected ratio **3** **4** **1;** 4

[11]

7. (a) (i) amino acids; 1

(ii) deamination/oxidation/redox; 1

(iii) liver; 1

(b) urea; (IGNORE ornithine cycle intermediates) 1

(c) (i) acetate/acetyl coenzyme A (and carbon dioxide); 1

(ii) matrix of mitochondrion; 1

(iii) ATP; 1

(d)
- detection by osmoreceptors;
- in hypothalamus;
- impulses to pituitary;
- pituitary produces/stores ADH; (*IGNORE issue of anterior or posterior)*
- ADH increases permeability of the collecting duct; of distal convoluted tubule;
- causes more water reabsorption;
- which raises blood WP;
- (*negative feedback explained re*.) explanation of norm level (of blood water potential);
- departure from the norm brings about a corrective mechanism, which restores the norm;
- ADH production inhibited/reduced if/as blood WP rises;

Any 8 from 11 8

[15]

8. (a) (i) *diagram should indicate*:
(appropriate) separation;
and then either: homologous partners distinguished;
chromosomes shown made up of two chromatids; 2

(ii) TB, Tb, tB, tb; 1

(b) (i) if chromosomes segregate without crossing over, only two gametic types possible (TA & ta);
crossing over enables exchange of chromosomal/genetic material (between them);
so new/different combinations of alleles produced (or specific example);
(below) any 2 from 3 (approach may also be diagrammatical) 2

(ii) more normal gamete types/crossing over (between loci) necessary/

rareness of event; 1

(iii) presence of chiasma/chiasmata; or drawn 1

(c) (1) independent assortment/random alignment of chromosomes;
new arrangement of alleles;

(2) random fertilisation;
chance combinations of gametes;

(3) mutation (or suitable description of);
creates new alleles/allelic combinations (by changes in DNA);
any two 'causes', to maximum of 4 from 6

(***NOTE*** *in any answer, full credit can be achieved only within TWO of possible three factors)* 4

(d) *(between the two groups*)
discontinuous variation
– discontinuous variation because the two groups don't overlap;
– genetic difference/major environmental difference;
– 2 different alleles at locus;(or similar);

continuous variation
– continuous variation as small sample size causes absence of 9-seed pods;
– probably caused by environmental factor(s);
– bimodal distribution explained as genetic difference/ major environmental cause;
(within each group)
continuous variation
– continuous variation as (complete) spread of seed numbers (within range);
– because many alleles/polygenic;
– probably caused by environmental factor(s);
any 4 from 9 4

[15]