01. 0610_s20_MS_43 Q: 3

| | | |
|---|---|---|
| (a) | transmission of genetic information from generation to generation ; | 1 |
| (b)(i) | **Tt** ;<br>**tt** ;<br>**TT** / **Tt** ; | 3 |
| (b)(ii) | cats **3** and **4** are homozygous recessive / do not have the allele for polydactyly ; | 1 |
| (c)(i) | *any two from:*<br>cats with normal number of toes have AGA for bases 7, 8 and 9 ;<br>cats with polydactyly have GGA or AGT ;<br>bases 7 and 9 are different / base 7 is G not A in the USA cats / base 9 is T not A in the UK cats ; | 2 |
| (c)(ii) | mutation ; | 1 |
| (c)(iii) | origin of the cat was USA ;<br>base sequence is the same as the other cats from the USA / they have the same, mutation/base sequence, as the Oregon and Missouri cats ; | 2 |
| (d) | T A<br>A T<br>A T<br>T A<br>G C<br>C G<br>G C<br>T A<br>G C<br>; | 1 |
| (e) | distinct, phenotypes / categories ;<br>no intermediates / phenotypes not on a continuous scale ; | 2 |

02. 0610_s19_MS_43 Q: 5

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) | caused by a mutation ;<br>change in, DNA / base sequence ;<br>of gene for haemoglobin ;<br>(causes) a different sequence of amino acids ;<br>(so) abnormal haemoglobin produced ;<br>AVP ; | 3 | |
| (b) | both parents carry the, recessive allele / allele for (sickle cell) anaemia ;<br>both parents are heterozygous ;<br>half the gametes of both parents have the recessive allele ;<br>people / children, who are homozygous recessive have (sickle cell) anaemia ;<br>there is a, 0.5 □ 0.5 / 0.25, chance of, being homozygous recessive / having (sickle cell) anaemia ; | 4 | |
| (c)(i) | (group of) organisms that can reproduce ;<br>to produce fertile offspring ; | 2 | |
| (c)(ii) | people with sickle cell anaemia / heterozygotes / carriers / are resistant to, malaria / AW ;<br>people with (homozygous) sickle cell anaemia are, less likely to survive / die of sickle cell disease ;<br>people who are heterozygous / have one copy of the sickle cell allele, are more likely to survive / have selective advantage ;<br>*idea that* they are more likely to breed ;<br>pass on allele for sickle cell ;<br>so increase in frequency of sickle cell allele (in population) ;<br>selective advantage for sickle cell only exists where, (mosquitoes carrying) malaria are present ;<br>AVP ; ref. to evolution / adaptation to (local) conditions | 5 | |

03. 0610_s17_MS_43 Q: 3

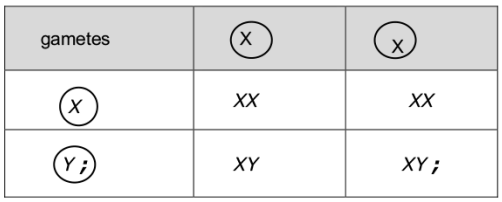
| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) | *description*<br>1 (stem) cells divide ;<br>2 by mitosis ;<br>3 to form, daughter / genetically identical, cells ;<br>4 nucleus buds off / AW ;<br>5 digested / broken down, mitochondria ;<br>6 only one of stem cells specialises / others continue to be stem cells ;<br><br>*adaptations*<br>7 haemoglobin made prior to, mitochondria / nucleus removed / maturation ;<br>8 (loss of structures) gives space for, oxygen transport / haemoglobin ;<br>9 haemoglobin, transports / AW, oxygen ;<br>10 biconcave shape / described ;<br>11 large surface area (to volume ratio) ;<br>12 for diffusion of oxygen / gas(es) ;<br>13 AVP ; | 6 | **MP1 I** reproduce<br><br>**MP4 A** no nucleus (in mature red blood cell)<br>**MP5 A** no mitochondria (in mature red blood cell)<br><br>**MP7** must be in correct place in sequence of events<br>**MP8 A** volume for space, **I** area<br>**MP12 I** ref to gas exchange |
| (b) | plasma ; | 1 | |
| (c) | replacement / repair / wound healing ;<br>cells die / are, rubbed off / exfoliated / AW ;<br>growth ; | 2 | |
| (d)(i) | iron / Fe / $Fe^{2+}$ / $Fe^{3+}$ ; | 1 | **R** ion unqualified<br>**A** vitamin $B_{12}$ |
| (d)(ii) | tired / lethargic / 'no energy' / weakness / AW ;<br>shortness of breath ;<br>chest pain ;<br>fast heartbeat ;<br>frequent infections ;<br>headache / dizziness / light-headedness ;<br>cold, hands / feet ;<br>inflammation / soreness, of tongue ;<br>brittle nails ;<br>unusual cravings for non-nutritive substances, such as ice, dirt or starch ;<br>poor appetite ;<br>tingling or crawling feeling in legs ; | 2 | **A** pale skin |
| (e) | 1 mutation ;<br>2 change in, base sequence / DNA ;<br>3 in gene / allele, for haemoglobin ;<br>4 inherit the allele (for sickle cell anaemia / mutated haemoglobin / $Hb^S$) ;<br>5 having the recessive allele(s) / being, homozygous recessive / $Hb^SHb^S$ / heterozygous / $Hb^SHb^A$ ;<br>6 produce, abnormal / AW, haemoglobin ;<br>7 red blood cells have, sickle shape / described ;<br>8 AVP ; | 4 | **I** references to malaria<br><br>**MP4 A** allele passed down from, a carrier / parent with sickle-cell anaemia |



04. 0610_s16_MS_41 Q: 3

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| **(a)** | *gene* a length of DNA that codes for a protein ;<br><br>*gene mutation* a change in base sequence of DNA ; | [2] | **R** chromosome / molecule of / genome |
| **(b) (i)** | 1 **Bb** ;<br>2 **bb** ;<br>3 **Bb** ; | [3] | |
| **(ii)** | (Bb x bb)<br><br>**B** , **b** + **b** , (**b**) ;<br><br>*offspring genotypes* **Bb** and **bb** ;<br>**A** heterozygous and homozygous recessive<br><br>*offspring phenotypes* normal / carrier and acatalasia ; | [3] | <table><tr><td colspan="2"></td><td colspan="2">male gametes</td></tr><tr><td colspan="2"></td><td>**B**</td><td>**b**</td></tr><tr><td rowspan="2">female gametes</td><td>**b**</td><td>**Bb**</td><td>**bb**</td></tr><tr><td>(**b**)</td><td>(**Bb**)</td><td>(**bb**)</td></tr></table> |
| **(iii)** | test (cross) ; | [1] | |
| | | **[Total: 9]** | |

05. 0610_s16_MS_43 Q: 3

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) |  <br>offspring ratio = 1:1 / 50:50 / 50% male, 50% female / 2:2 ; | [3] | |
| (b) (i) | **cat 1** $X^bY$ ;<br>**cat 4** $X^BY$ ;<br>**cat 5** $X^BX^B$ ; | [3] | |
| (ii) | distinct, phenotypes / coat colours / categories ;<br>no (continuous) range of colour / AW ;<br>controlled by genes ;<br>not affected by the, environment / AW / named example ; | [3] | **A** only orange, black and calico<br>**A** inherited |
| | | **[Total: 9]** | |

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06. 0610_m19_MS_42 Q: 5

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a)(i) | **1** leaf **A** / thick cuticle, lost the least mass / water ;<br>**2** leaf **C** / thin cuticle, lost the most mass / water ;<br>**3** leaf **B** / medium cuticle, lost more mass or water than **A** / less mass or water than **C** ;<br>**4** loss of mass is due to the loss of water ;<br>**5** the thicker the cuticle the, less water / mass, lost ;<br>**6** loss of, mass / water, fastest initially (then slows) ;<br>**7** ref. to transpiration / (reduced) evaporation ;<br>**8** data manipulation with ref. to mass ; e.g. calculation of loss | 5 | |
| (a)(ii) | less, water / mass, loss (from leaves **A**, **B** and **C**) ;<br>*idea of* the same pattern of results as the first experiment ;<br>reduced transpiration ;<br>increased water (concentration) in the air ;<br>ref. to a smaller concentration gradient ;<br>less diffusion of water vapour ; | 3 | |
| (b) | *stem* – swollen / AW ;<br>*root* – extensive / widespread / shallow (root system) / AW ; | 2 | **A** deep / branched |
| (c)(i) | carbon dioxide ; | 1 | |
| (c)(ii) | respiration ;<br>starch ;<br>cellulose ;<br>chlorophyll ;<br>sucrose ;<br>nectar ;<br>amino acids / protein ;<br>fats / oils ;<br>nucleic acids / DNA / RNA ;<br>growth of (any named part) membrane, cell wall, cytoplasm ; | 3 | |

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07. 0610_w18_MS_43 Q: 5

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) | dry / AW ; | 1 | |
| (b)(i) | discontinuous ; | 1 | |
| (b)(ii) | limited number of phenotypes / three categories ;<br>no intermediates / discrete / separate categories / AW ;<br>caused by genes only ;<br>bar chart (has gaps) ; | 2 | |
| (c) | thickness / length / width / mass / concentration of pigment / volume / surface area, of any leaf feature / density of stomata / number of, veins / chloroplasts / spikes ;; | 2 | **A** concentration for density |
| (d) | measured different leaves ;<br>change in (named) environmental (feature) ;<br>adapted to environment ;<br>leaves / plant, have, grown / older ;<br>AVP ; | 1 | **A** mutation |

08. 0610_w16_MS_42 Q: 4

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) | guard cells; | 1 | |
| (b) | Brazilian waterweed / *E. densa*, exchanges (dissolved) (named) gas(es) with the water;<br>Water lily / *N. lutea*, exchanges (named) gas(es) with the air; | 2 | |
| (c)(i) | (group of) similar cells that, work together / carry out a shared (named) function; | 1 | |
| (c)(ii) | xylem;<br>phloem;<br>epidermis;<br>spongy mesophyll; | 2 | **R** cuticle<br><br>**A** aerenchyma |
| (d) | air spaces in the leaf for, buoyancy / AW;<br><br>*max 1 for any of the following*<br>leaves are closer to the light / 'gets more light'<br>to absorb more light;<br>for more photosynthesis;<br>to exchange gases with the, air / atmosphere; | 2 | **1 + 1**<br>**A** floating **I** being on the surface |
| (e) | xerophyte(s); | 1 | |
| (f) | inherited feature ;<br>feature helps an organism survive and reproduce;<br>in its, habitat / environment;<br>(a named) adaptive feature increases organism's fitness; | 2 | |
| | | **Total: 11** | |

09. 0610_s19_MS_41 Q: 1

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) | (group of) organisms that can reproduce ;<br>to produce fertile offspring ; | 2 | |
| (b) | pinna(e) / external ears ;<br>mammary glands / milk glands / production of milk / lactating / suckling / breast feeding / nipples / AW ;<br>diaphragm ;<br>(three) bones in the middle ear ;<br>(four) different types of teeth / two sets of teeth ;<br>sweat glands ;<br>enucleated red blood cells ;<br>uterus / placenta / navel / AW ;<br>AVP ; | 2 | |
| (c) | select, parent(s) / sheep / AW, with, fine / thin, hairs (in wool)<br>OR<br>use Merino sheep from South Africa and NZ sheep ;<br><br>cross them together / use artificial insemination / IVF / AW ;<br>measure / AW, the hairs in the wool of all the offspring ;<br>select offspring with, fine / thin, hairs (in wool) ;<br>cross / AW, offspring together ;<br>continue / repeat, selection and/or breeding ;<br>over many generations ;<br>AVP ; | 5 | max 4 if no reference to quality of wool |
| (d) | features are, adaptive / adaptations (for environment) ;<br>caused by / AW, the, environment / surroundings ;<br>competition between individuals for (named) resource(s) ;<br>reference to named selective agent(s) ;<br>slow(er) ;<br>increase in fitness ;<br>explained: ability to survive AND reproduce (in natural environment) ;<br>maintains (genetic) variation / less (genetic) variation in selective breeding ;<br>random mating ; | 3 | |

10. 0610_w17_MS_43 Q: 3

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a)(i) | DNA ; | 1 | **A** correct elements<br>**I** RNA |
| (a)(ii) | *parental phenotypes* resistant x not disease-resistant<br>*parental genotypes* Rr ; x rr ;<br>*gametes* R r x r (r) ;<br>*offspring genotype* Rr and rr ;<br>*offspring phenotype* resistant and not resistant / AW ; | 5 | **ecf** from previous line above throughout |
| (b)(i) | heterozygous, plant / parent, carry the not-resistant / r, allele ;<br>some offspring would be, not-resistant / rr / homozygous recessive ;<br>using heterozygotes results in profit loss / AW ; | 2 | **A** homozygous dominant = no r allele / only R<br>**A** therefore all offspring are disease-resistant |
| (b)(ii) | paint pollen onto selected trees / AW ;<br>isolate plants / cover flowers, of unselected trees ;<br>identify not disease resistant trees ;<br>AVP ; remove not-resistant trees | 1 | **A** artificial pollination |
| (b)(iii) | human choice (rather than environmental pressures) / AW ;<br>less, diversity / variation ;<br>faster change ;<br>AVP ; e.g. mating is not random | 2 | **A** named features for human use<br>**A** reduced fitness (of species) |