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**Cambridge Ordinary Level**

# MARK SCHEME for the October/November 2015 series

## 5090 BIOLOGY

**5090/21** Paper 2 (Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Mark schemes will use these abbreviations:

| | |
|---|---|
| **;** | separates marking points |
| **/** | alternatives |
| **()** | contents of brackets are not required but should be implied |
| **R** | reject |
| **A** | accept (for answers correctly cued by the question, or guidance for examiners) |
| **I** | ignore (for incorrect but irrelevant responses) |
| **AW** | alternative wording (where responses vary more than usual) |
| **AVP** | alternative valid point (where a greater than usual variety of responses is expected) |
| **ORA** | or reverse argument |
| **underline** | actual word underlined must be used by candidate (grammatical variants excepted) |
| **max** | indicates the maximum number of marks that can be given |
| **+** | statements on both sides of the + are needed for that mark |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| 1 (a) | (cell) membrane / cytoplasm / nucleus ;<br>pulled / moved away from (cell) wall / plasmolysed ;<br>vacuole ;<br>reduced in size / smaller / AW ; | [max. 3] | |
| (b) | ref. direction of water potential / concentration gradient / AW ;<br>osmosis / diffusion ;<br>(movement of) <u>water</u> out of cells ;<br>ref. partial permeability AW of (cell) membrane ; | [max. 3] | |
| | | **[Total: 6]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| 2 (a) | **X**<br>right ventricle ;<br><br>pulmonary artery ;<br><br>**Y**<br>left ventricle ;<br><br>aorta ; | [4] | |
| (b) (i) | line decreases (lowest at capillaries) followed by increase ;<br><br>vein diameter drawn to be higher than artery ; | [2] | |
| (ii) | ref. heart / ventricle + pump / source of pressure ;<br><br>pressure relates to distance from heart / pump ;<br><br>resistance / friction ;<br><br>narrow lumen (in artery) ;<br><br>thick / muscular / elastic <u>walls</u> (in artery) ;<br><br>generation of <u>tissue fluid</u> in capillaries ; | [max. 4] | **A** arteries take blood from / are close to heart<br><br>**ORA** for vein |
| (c) (i) | <u>valve</u> ;<br><br>prevents backflow of blood / allows flow in one direction only ; | [2] | |

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| | | | |
|---|---|---|---|
| **(ii)** | muscle(s) ;<br>contract ;<br>put pressure + wall of vein / blood in vein ; | [max. 2] | |
| | | **[Total: 14]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| 3 (a) (i) | discontinuous ; | [1] | |
| (ii) | no intermediate values / distinct / separate categories ; | [1] | |
| (iii) | (63 / 100) × 10 ;<br>6.3 million / 6 300 000 / 6.3 × $10^6$ ; | [2] | award 2 marks for correct answer alone |
| (b) (i) | 4 (%) ; | [1] | |
| (ii) | ref. alleles / genes ;<br>each person has two (for blood group) ;<br>different (allele / gene) frequency in different populations ;<br>ref. inbreeding (of separate groups) AW ; | [max. 2] | **A** example of inbreeding e.g. geographical isolation / culture |
| (c) | blood transfusion / tissue (**A** blood donor) / organ transplant ;<br>clotting with ref. to blood / prevent rejection ;<br>to check paternity ; | [max. 2] | **A** if ref. is to donor or recipient<br>**A** ORA |
| (d) | $I^AI^o$ + $I^BI^o$ ;<br>A + B ; | [2] | |
| | | **[Total: 11]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| **4 (a) (i)** | 11 / 12 day(s) ;<br><br>13 / 14 day(s) ; | <br><br>[2] | **A** 11th or 12th day |
| **(ii)** | day 14 ; | [1] | |
| **(iii)** | progesterone (concentration) falls / not maintained ;<br><br>ref. figure day 24 – 28 ;<br><br>progesterone needed to maintain lining / pregnancy ; | <br><br><br><br>[max. 2] | |
| **(b)** | FSH ;<br>development of follicle / maturation / release of egg / ovum ;<br>stimulates production of oestrogen ;<br><br>oestrogen ;<br>repairs / builds up / thickens / develops uterus lining ;<br>maturation of egg / ovum ;<br>inhibits production of FSH ;<br>stimulates production of LH ;<br><br>LH ;<br>ovulation / release of egg / ovum ; | [1]<br><br>[max. 1]<br><br>[1]<br><br><br><br>[max. 1]<br><br>[1]<br>[1]<br><br>[max. 4] | **A** oestradiol for oestrogen throughout |
| | | **[Total: 9]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| 5 (a) | *wilting:*<br>root hairs removed / roots damaged ;<br><br>stem / xylem damaged ;<br><br>less water absorbed ;<br><br>plant loses water / transpires ;<br><br>cells lose water / cells become flaccid ;<br><br>*recovery:*<br>root (hairs) regrow ;<br><br>(more) water absorbed ;<br><br>cells gain water again / become turgid ; | [max. 4] | **R** no water absorbed<br><br>allow max.3 marks for *wilting* answers |
| (b) | carbon dioxide + water → oxygen ; | [1] | accept words or chemical formulae or a correctly balanced symbol equation<br>**I** light / chlorophyll |
| (c) (i) | **P** = (lower) epidermal cell / epidermis / epidermal layer ;<br><br>**Q** = guard cell ;<br><br>**R** = stoma / stomata ; | [3] | |
| (ii) | fewer / no stomata / guard cells ;<br><br>reduce / stop water loss / transpiration ;<br><br>(appears) shiny / bright / ref. to cuticle ; | [max. 2] | |
| | | **[Total: 10]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| 6 (a) | <u>molecules</u> large + must be converted to smaller ;<br><br>insoluble + need to be converted to soluble / non-diffusible to diffusible AW ;<br><br>to be <u>absorbed</u> ;<br><br>from (small) intestine / ileum ;<br><br>into blood / capillaries / lymph / lacteals ; | [max. 3] | **A** across intestine wall / into villi |
| (b) | bile from + liver / gall bladder / bile duct ;<br><br>ref. emulsification ;<br><br>increased surface area ;<br><br>ref. provision of optimum pH / alkaline conditions ;<br><br>small intestine / duodenum ;<br><br>lipase ;<br><br>from pancreas ;<br><br>fatty acids ;<br><br>glycerol ; | [max. 7] | |
| | | **[Total: 10]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| 7 (a) | ciliary muscles ;<br>relax ;<br>suspensory ligaments ;<br>tighten / become taut / pulled AW ;<br>increased tension / pull on lens ;<br>lens long + thin / flatter / less fat / convex ;<br>light refracted / bent (by lens) ;<br>(light) converges / (produces image) on retina / fovea ; | [max. 6] | **R** bent more |
| (b) | nervous system quicker AW / hormones slower ;<br>example of relevant situation ;<br>electrical / impulses ;<br>via neurones / nerve cells ;<br>hormones are chemical ;<br>carried / transported via blood ; | [max. 4] | |
| | | **[Total: 10]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| **8** | 1 red blood cells + transport / absorb / carry oxygen AW ;<br>2 no nucleus / biconcave / 'doughnut' shape AW + increased surface area ;<br>3 (oxy)haemoglobin ;<br>4 ref. (oxygen) diffusion into tissues / red blood cells ;<br>5 white blood cells / named + immunity / immune system / destroy pathogens / bacteria / viruses / named pathogen ;<br>6 phagocytes / phagocytosis ;<br>7 antibodies / anti-toxins ;<br>8 ref. tissue rejection ;<br>9 plasma + transport / carry ;<br>10 dissolved / in solution ;<br>11 **two** named chemicals transported ;<br>12 heat transported ;<br>13 platelets + blood clotting / plug hole ;<br>14 fibrinogen + to fibrin ; | [max 10] | **A** any three components named for 1 mark max. if no marks awarded for lack of accompanying explanations<br>**I** germs / foreign bodies<br>**A** urea, $CO_2$ , vitamins, etc. |
| | | **[Total: 10]** | |

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| Question | Expected Answer | Mark | Additional guidance |
|---|---|---|---|
| 9 (a) | removal from organism / body ;<br><br>toxic / poisonous ;<br><br>waste (products) ;<br><br>from metabolism ; | [max. 3] | |
| (b) | 1 <u>blood</u> from patient to machine / returned to patient ;<br><br>2 using <u>partially permeable</u> membrane / tubes AW ;<br><br>3 ref. dialysis fluid ;<br><br>4 ref. relative concentrations AW ;<br><br>5 filters / removes substances from + blood / unwanted out / wanted in ;<br><br>6 by <u>diffusion</u> ;<br><br>7 urea / nitrogenous products / toxins / poisons ;<br><br>8 salt(s) / ions / small molecules ;<br><br>9 excess water / ref. osmoregulation ;<br><br>10 large molecules / proteins stay in blood ;<br><br>11 practical aspect e.g. bubble trap / repetition / frequency / duration of procedure / dialysis fluid frequently changed / temperature ref / counter flow ; | [max. 7] | |
| | | **[Total: 10]** | |

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