



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES

0654/31

Paper 3 Theory (Extended)

October/November 2016

MARK SCHEME

Maximum Mark: 120

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

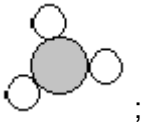
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| Question | Answer | Marks |
|-----------------|--|--------------|
| 1(a)(i) | nitrogen ; oxygen ; | 2 |
| 1(a)(ii) | little / no overall change then increases ; some fluctuations ; increases from 1800 ; by 0.0065% ; | max 3 |
| 1(b)(i) | respiration / decomposition / excretion ; | 1 |
| 1(b)(ii) | photosynthesis ; | 1 |
| 1(c) | (increased:) burning of fossil fuels ; deforestation ; industrialisation ; human population / activity ; | max 2 |
| 1(d) | measure content of air at present ; measure sample from most recent ice ; | 2 |
| 1(e) | absorbs radiation / IR / heat / energy ; radiates back to Earth ; | 2 |
| | Total: | 13 |

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| Question | Answer | Marks |
|-----------------|--|--------------|
| 2(a)(i) | D AND hydrogen ; | 1 |
| 2(a)(ii) | C AND carbon dioxide ; | 1 |
| 2(a)(iii) | B AND copper (too) unreactive (to displace hydrogen from dilute acid)/copper less reactive than hydrogen ; | 1 |
| 2(a)(iv) | A AND barium sulfate ; | 1 |
| 2(b)(i) | 28 ; 23 ; | 2 |
| 2(b)(ii) | transition (series /metals) ; | 1 |
| 2(b)(iii) |  ; | 1 |
| 2(b)(iv) | $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ formulae ; balanced ; | 2 |
| | Total: | 10 |

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| Question | Answer | Marks |
|-----------------|---|--------------|
| 3(a)(i) | some of the water in kettle C has boiled away / evaporated ; | 1 |
| 3(a)(ii) | latent heat (of vaporisation) / (energy required) to separate molecules from each other ; | 1 |
| 3(a)(iii) | evaporation can occur at any temperature / boiling only happens at the boiling point ; evaporation happens only at the surface / boiling happens throughout the liquid ; boiling takes energy in (endothermic) to occur / evaporation lets only the molecules with the highest kinetic energy out ; evaporation can occur using the internal energy of the system / boiling requires an external source of heat ; evaporation produces cooling / boiling does not ; evaporation is a slow process / boiling is a rapid process ; | max 2 |
| 3(a)(iv) | (water is) B AND most particles are touching and random arrangement ; (water vapour is) C AND particles are spread out (and random arrangement) ; | 2 |
| 3(b) | convection ; heated water is less dense / expands ; hot water rises ; | max 2 |
| 3(c) | $(I) = P / V ;$ $= 2000 / 250 (= 8 \text{ A}) ;$ | 2 |
| | Total: | 10 |

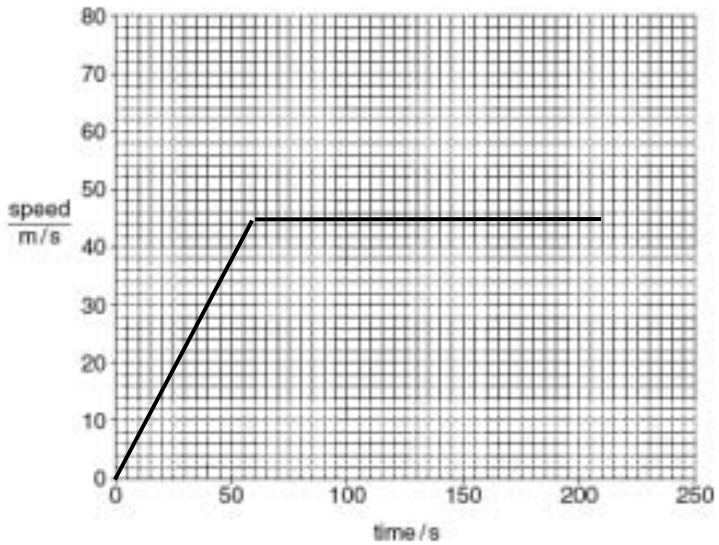
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| Question | Answer | Marks |
|-----------------|--|--------------|
| 4(a) | mitosis ; | 1 |
| 4(b)(i) | identical ; | 1 |
| 4(b)(ii) | similar ; | 1 |
| 4(c) | retains humid air around the cutting ; reduces water loss / transpiration ; | 2 |
| 4(d)(i) | stunted growth ; | 1 |
| 4(d)(ii) | yellow leaves ; | 1 |
| | Total: | 7 |

| Question | Answer | Marks |
|-----------------|--|--------------|
| 5(a)(i) | (zinc) changes from grey to darker grey / brown / pink ; copper forms on the surface ; OR (copper sulfate) changes from blue to less blue / colourless ; copper (ion) is removed / displaced from the solution / owtte ; | 2 |
| 5(a)(ii) | (26) this is iron ; metal M less reactive than zinc but more reactive than copper / silver ; the other metals (are sodium and calcium which) are both more reactive than zinc ; | max 2 |
| 5(b)(i) | aqueous / water solution ; | 1 |

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| Question | Answer | Marks |
|----------|--|-----------|
| 5(b)(ii) | zinc (atoms) lose electrons and are oxidised ; silver (ions) gain electrons and are reduced ; | 2 |
| 5(c) | increases / gets faster / goes up ; exothermic ; chemical / chemical potential ; | 3 |
| | Total: | 10 |

| Question | Answer | Marks |
|----------|---|-------|
| 6(a)(i) | <p>Acceleration line gradient correct ; Constant velocity line correct at 45 m/s for 150 s anywhere ;</p>  <p>The graph plots speed in m/s against time in seconds. The vertical axis (speed) ranges from 0 to 80 with major grid lines every 10 units and minor grid lines every 2 units. The horizontal axis (time) ranges from 0 to 250 with major grid lines every 50 units and minor grid lines every 10 units. The plotted line starts at the origin (0,0), rises linearly to a point at approximately 60 seconds and 45 m/s, and then continues as a horizontal line at 45 m/s until approximately 210 seconds.</p> | 2 |

| | | | |
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| Question | Answer | Marks |
|-----------------|--|--------------|
| 6(a)(ii) | Area under graph / AVP ; | 1 |
| 6(b) | Speed = 45 m/s ; KE = $\frac{1}{2}mv^2$ / $\frac{1}{2} \times 6.0 \times 10^5 \times 45 \times 45$; 6.1×10^8 (J) ; | 3 |
| 6(c) | Force = mass \times acceleration / ma / $6.0 \times 10^5 \times 0.75$; 4.5×10^5 (N) ; | 2 |
| | Total: | 8 |

| Question | Answer | Marks |
|-----------------|---|--------------|
| 7(a) | environment ; negative ; (3rd line) away from AND towards ; | 3 |
| 7(b)(i) | 12.30 ; | 1 |
| 7(b)(ii) | Eats a meal ; | 1 |
| 7(b)(iii) | respiration ; glycogen synthesis ; insulin secretion ; | max 2 |
| 7(c) | liver converts glucose to glycogen / glycogen to glucose ; liver stores glycogen ; insulin causes uptake of glucose ; glucagon causes release of glucose ; | max 3 |
| | Total: | 10 |

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| Question | Answer | Marks |
|-----------------|---|--------------|
| 8(a)(i) | 2– ; gains 2 electrons to complete outer shell ; more (negative) electrons than (positive) protons ; | 3 |
| 8(a)(ii) | 2+ ; reference to the need for charge balance ; | 2 |
| 8(b) | zinc <u>ions</u> are attracted / move to the cathode ; zinc <u>ions</u> , gain electrons / are discharged, at the cathode ; | 2 |
| 8(c)(i) | galvanised ; | 1 |
| 8(c)(ii) | sacrificial protection / sacrificial barrier ; (if steel exposed) zinc rather than steel corrodes ; because zinc more reactive (than iron) ; | max 2 |
| 8(d) | malleable refers to ability to be shaped (without breaking) ; | 1 |
| | Total: | 11 |

| Question | Answer | Marks |
|-----------------|--|--------------|
| 9(a)(i) | fission is splitting of <u>nuclei</u> and fusion is joining of <u>nuclei</u> ; | 1 |
| 9(a)(ii) | ${}_{94}^{239}\text{Pu} \rightarrow {}_{92}^{235}\text{U} + 4\alpha$ $\frac{4}{2}\alpha / \frac{4}{2}\text{He}$; ${}_{92}\text{U}$; Nucleon number of daughter nuclide: 235 ; | 3 |
| 9(b)(i) | reduces energy / power losses ; | 1 |

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| Question | Answer | Marks |
|-----------------|--|--------------|
| 9(b)(ii) | $N_s = N_p \times V_s / V_p$; = $5000 \times 600\,000 / 25\,000$; = 120 000 ; | 3 |
| 9(c)(i) | resistance decreases / any answer in the range $0 < R < 6.5$; resistance is halved / 3.25 ohms ; | 2 |
| 9(c)(ii) | material / temperature ; | 1 |
| 9(c)(iii) | cable will have greater, mass / weight / heavier ; more force on pylons / need stronger pylons / heavier cables damage pylons ; | 2 |
| | Total: | 13 |


| Question | Answer | Marks |
|-----------------|---|--------------|
| 10(a)(i) | X = placenta ; Y = amniotic fluid ; Z = umbilical cord ; | 3 |
| 10(a)(ii) | protection ; | 1 |
| 10(a)(iii) | less oxygen ; less (named) nutrient(s) ; more CO ₂ ; more urea ; | max 3 |
| 10(b)(i) | antibodies from mother ; mother-baby bonding ; correct <u>balance of</u> nutrients ; no need for sterilising equipment ; | max 2 |

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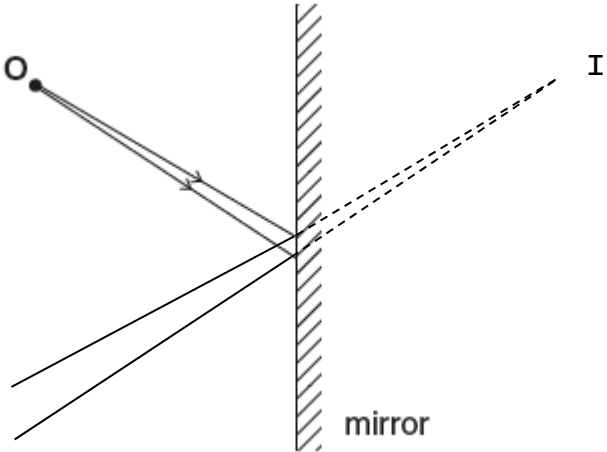
| Question | Answer | Marks |
|-----------------|--|--------------|
| 10(b)(ii) | know how much the baby has had ; no need for presence of mother ; less chance of transfer of disease from mother ; | max 1 |
| | Total: | 10 |

| Question | Answer | Marks |
|-----------------|---|--------------|
| 11(a) | cobalt chloride paper turns pink ; showing water (vapour) (in the combustion products) ; limewater turns milky ; showing carbon dioxide (in the combustion products) ; | 4 |
| 11(b) | ethene and water/steam ; | 1 |
| 11(c)(i) | $(12 \times 2) + (1 \times 6) + (1 \times 16) (= 46)$; | 1 |
| 11(c)(ii) | calculate number of moles in 0.25 dm^3 : $0.5 \div 4 = 0.125$; calculate mass of ethanol = $46 \times 0.125 = 5.75$; units are g ; | 3 |
| | Total: | 9 |

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| Question | Answer | Marks | | | | | | | | | | |
|------------|--|-------|------------|-----------|--|-----------|--|-------|--|------------|---|---|
| 12(a)(i) |  | 1 | | | | | | | | | | |
| 12(a)(ii) | travel at same speed ; | 1 | | | | | | | | | | |
| 12(a)(iii) | (more) ionising ; | 1 | | | | | | | | | | |
| 12(b) | <p>4 or 3 correct = 2 marks , 2 or 1 correct = 1 mark ;</p> <table border="0"> <thead> <tr> <th>term</th> <th>definition</th> </tr> </thead> <tbody> <tr> <td>amplitude</td> <td>how far the wave travels in one second</td> </tr> <tr> <td>frequency</td> <td>the distance from any point on one wave to the same point on the next wave</td> </tr> <tr> <td>speed</td> <td>the distance from the centre of a wave to the top or to the bottom of the wave</td> </tr> <tr> <td>wavelength</td> <td>the number of waves passing a fixed point in one second</td> </tr> </tbody> </table> | term | definition | amplitude | how far the wave travels in one second | frequency | the distance from any point on one wave to the same point on the next wave | speed | the distance from the centre of a wave to the top or to the bottom of the wave | wavelength | the number of waves passing a fixed point in one second | 2 |
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| Question | Answer | Marks |
|-----------|--|----------|
| 12(c)(i) | reflected rays correctly drawn ; | 1 |
| 12(c)(ii) | construction lines drawn behind mirror and image correctly located ;  | 1 |
| 12(d)(i) | focal length correctly identified ; | 1 |
| 12(d)(ii) | refraction ; | 1 |
| | Total: | 9 |