

Mark Scheme for June 2012

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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







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1. Annotations

| Annotation | Meaning |
|---|--|
|  | Unclear |
|  | Benefit of Doubt |
|  | Cross |
|  | Error carried forward |
|  | Example / reference |
|  | Ignore |
|  | Not answered question |
|  | Benefit of Doubt not given |
|  | Large Dot (Key point attempted) |
|  | Reject |
|  | Contradiction |
|  | Error in number of significant figures |
|  | Tick |
|  | Omission Mark |

Highlighting is also available to highlight any particular points on the script.

The following questions should be annotated with ticks to show where marks have been awarded in the body of the text:
2(b), 4(c), 6(b), 7(b)(iii) and 12(a)

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

- / = alternative and acceptable answers for the same marking point
- (1)** = separates marking points
- not** = answers which are not worthy of credit
- reject** = answers which are not worthy of credit
- ignore** = statements which are irrelevant
- allow** = answers that can be accepted
- () = words which are not essential to gain credit
- = underlined words must be present in answer to score a mark
- ecf = error carried forward
- AW = alternative wording
- ora = or reverse argument

| Question | | Expected Answers | Marks | Additional Guidance |
|--------------|-----|--|------------------|---|
| 1 | (a) | Between -50 and -45 ✓ | 1 | |
| | (b) | (i) Infrared radiation is absorbed by air molecules (esp CO ₂ and H ₂ O vapour) ✓ Increases vibrations (kinetic energy of molecules OR air warms up) ✓ Air expands and rises ✓ | 1 1 1 | Air in contact with earth's surface is heated (1) Air expands and rises must be linked (1) |
| | | (ii) Tropopause colder (below -50) Air spreads out horizontally contracts ✓ Thus descends ✓ | 1 1 | |
| | | (iii) <u>Differences</u> in air pressure ✓ Rotation of earth (coriolis effect) ✓ | 1 1 | Allow movement of Earth |
| | (c) | Select $P = F/A$ $A = 2^2 = 4$ $P = 396\ 000/4 = 99\ 000$ (or std.frm) Pa or Nm ⁻² | 1 1 1 1 | |
| Total | | | 12 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|----------|-----|-------|--|--|--|
| 2 | (a) | (i) | Seasonal variation (summer and winter) ✓ | 1 | Credit any indication of seasonal variation |
| | | (ii) | Away from localised pollution ✓ | 1 | |
| | (b) | (i) | Thickness of tree rings give evidence of how much tree grew in a given time period ✓ This may correlate with climate variation eg Temperature / rainfall etc. ✓ | 1 1 | Allow any difference in tree rings suggested |
| | | | (ii) | <u>Atoms</u> of the same element (same p number) With different numbers of neutrons | |
| | | (iii) | | Neutrons 10, 8 ✓ Protons 8,8 ✓ Electrons 8,8 ✓ | |
| | | | (iv) | Electron number (configuration) the same ✓ | |
| | | | Total | 10 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|--------------|-----|-------|--|-----------|---|
| 3 | (a) | (i) | (Rapid) burning (in air / oxygen) ✓ | 1 | Combustion (1) oxidation (1) Accept exothermic (?) |
| | | (ii) | (+) 4 ✓ | 1 | |
| | (b) | (i) | Acid is a proton donor ✓ | 1 | Allow pH <7 (1) Solution with H⁺ ions (1) |
| | | (ii) | H ⁺ + HCO ₃ ⁻ or 2H ⁺ + CO ₃ ²⁻ ✓ H ⁺ + HSO ₃ ⁻ or 2H ⁺ + SO ₃ ²⁻ ✓ | 1 | Must have both Allow H₂CO₃ and H₂SO₃ (elements can be in any order) |
| | | (iii) | Sulfurous acid more dissociated than carbonic ✓ This greater conc. Of H ⁺ ions ✓ | 1 1 | |
| | (c) | | Apparatus burette ✓ Pipette AND conical flask ✓ Indicator ✓ (need not be named) Standardized alkali ✓ (need not be named) End point indicated by colour change ✓ Average titre taken to improve reliability ✓ | 6 | Fixed volume of acid or alkali (1) QWC Correct sequence of steps (1) |
| Total | | | | 12 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|----------|-----|-------|---|-----------------------|---|
| 4 | (a) | (i) | Improve yield ✓ Improve drought resistance ✓ Herbicide resistance ✓ Production of medicines ✓ | Any 2 | Allow taste better (1) |
| | | (ii) | Restriction enzyme recognises a particular nucleotide sequence ✓ Cuts the polymer at a particular point ✓ | 1 1 | |
| | | (iii) | Plasmid ✓ Virus ✓ Gold nano particles ✓ Viral infection (for virus) ✓ Infection with bacteria with host plasmid ✓ Gold nanoparticles ✓ | Any 3 | Any named vectors (1) each max 2 1 for description method |
| | (b) | | Long term effects of genetically modified plants on health not known ✓ Carry out long term trials (on animals) ✓ Genetic modification may transfer to other plants ✓ Ensure complete isolation of experimental trials ✓ QWC | 1 1 1 1 1 | 2 concerns + one technique of minimising = 4 + 1 for QWC "Playing god" gets (1) |
| | | | Total | 12 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|--------------|-----|------|--|------------------|--|
| 5 | (a) | (i) | High melting point ✓ Denser when solid ✓ High specific Heat ✓ | Any 2 | Just stating mpt and/or bpt = 0 |
| | | (ii) | Density = mass/vol selected AND arranged ✓ Vol = $3.5/996 = 0.00351$ m^3 ✓ 3.51×10^{-3} ✓ | 1 1 1 1 | 4 th mark for answer in standard form |
| | (b) | (i) | One bonding pair shown ✓ One non bonding pair shown ✓ All correct ✓ | 1 1 1 | Can be from separate diagram |
| | | (ii) | Diagram showing water molecule with correct dipoles on H and O ✓ Hydrogen bond correctly shown between 2 water molecules ✓ Difference in electronegativity mention as cause for polar bond ✓ Strong inter molecular forces result ✓ | 1 1 1 1 | Marks can be awarded from diagram |
| | (c) | (i) | Exothermic is a reaction that gives out heat ✓ | 1 | |
| | | (ii) | Due to bond formation ✓ (releases heat) Condensation is formation of H bonds ✓ | 1 1 | |
| Total | | | | 16 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|--------------|---------|--|-------------|-----------------------------------|
| 6 | (a) | The splitting ✓ Of atomic nuclei ✓ | 1 1 | |
| | (b) (i) | Gamma is highest energy ✓ Therefore most penetrating Only lead is sufficient to shield ✓ | 1 1 | Accept thick layers of concrete |
| | (ii) | Np Mass = 237 ✓ Mass of alpha = 4 ✓ Number of alpha = 2 ✓ | 1 1 1 | |
| | (c) | Alpha source (1) Thin beam (1) Aimed at gold foil (1) Phosphorescent screen (1) Most particles past through foil (1) Some deflected (1) Small number rebound (1) Suggesting most mass at centre (1) Repulsion due to +ve charge on nucleus (1) | Any 6 | Marks can be awarded from diagram |
| Total | | | 13 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|----------|-----|-------|--|-----------------------|---|
| 7 | (a) | (i) | Voltage is increased ✓ | 1 | Accept "it is stepped up" |
| | | (ii) | So as to minimise energy loss (as heat) ✓ | 1 | |
| | | (iii) | ac alternates direction of flow (100 times a second)✓ (or opposite argument for dc) | 1 | Simply stating that ac = alternating current and dc = direct current gets 0 |
| | | (iv) | Power = $V \times I$ ✓ Power = $230 \times 20 = 4600$ (W) ✓ Power = J/s so 4600 J per s ✓ 10 mins = 600 s Energy used = $4600 \times 600 = 2.76 \times 10^6$ ✓ Joules ✓ (2760 kJ) | 1 1 1 1 1 | |
| | (b) | (i) | O ₂ ✓ CO ₂ ✓ 2 O ₂ ✓ | 1 1 1 | |
| | | (ii) | Oxygen is lost ✓ | 1 | |
| | | (iii) | Combustion of hydrogen only gives water ✓ But production of hydrogen produces carbon dioxide ✓ | 1 1 | |
| | | | Total | 14 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|--------------|-----|---|--|-------------|--|
| 8 | (a) | (i) | Highest energy/most ionising ✓ Most likely to cause cell damage (cancer) ✓ | 1 1 | Causes cancer WITHOUT justification = 0 |
| | | (ii) | Selects and rearranges $E = hf$ ✓ $f = 1.3 \times 10^{-18} / 6.63 \times 10^{-34} = 1.96 \times 10^{15}$ ✓ | 1 1 | |
| | | (iii) | $c = f\lambda$ selected ✓ $\lambda = 3.0 \times 10^8 / 1.96 \times 10^{15} = 1.53 \times 10^{-7}$ ✓ m 153 nm ✓ | 1 1 1 | |
| | (b) | Describe main features of cohort study Group identified exposed to factor (1) Control group (1) Control group must be as similar as possible to test group to control other variables (1) Follow over a period of time (1) Weakness, difficulty of controlling all variables (1) Length of time taken for study | Any 3 1 | | |
| Total | | | | 11 | |

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