

MARK SCHEME for the May/June 2013 series

0653 COMBINED SCIENCE

0653/31

Paper 3 (Extended 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.

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

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- 1 (a) (i) (A)
sum of protons and neutrons is four/nucleon number is sum of protons and neutrons; [1]
- (ii) numbers of protons and electrons are the same;
protons positive electrons negative;
charges (of protons and electrons) cancel; [max 2]
- (b) (i) atoms share electrons;
electron pair (is shared);
electron pair lies between nuclei/shields nuclear repulsion; [max 2]
- (ii) helium (atoms) inert/stable;
reference to complete (outer) shell; [max 1]
- (c) pop (test) indicates hydrogen (given off);
zinc displaces hydrogen/reacts with HCl to produce hydrogen;
zinc more reactive than hydrogen;
silver less reactive than hydrogen (so no reaction); [max 3]
(allow max 1 if only response is *zinc is more reactive than silver*)
- [Total: 9]**
- 2 (a) (i) distance = speed × time;
= 1600 × 0.2/2 = 160 m; [2]
- (ii) (frequency =) velocity ÷ wavelength;
frequency = 1600/0.25 = 6400 Hz; [2]
- (b) (i) idea that fossil fuels are conserved;
no CO₂/greenhouse gas emissions;
ref. to global warming/reduced consequence of global warming described;
no emissions causing acid rain; [max 2]
- (ii) transfer of KE to PE as water moves up chamber;
transfer of KE to air inside chamber;
transfer of KE of air to KE of (rotation of) turbine;
transfer of KE of turbine to KE of generator;
transfer of KE of generator to electrical energy; [max 2]
(allow strong implication of these transfers)
- (c) (i) sea water; [1]
- (ii) evaporation; [1]
- [Total: 10]**

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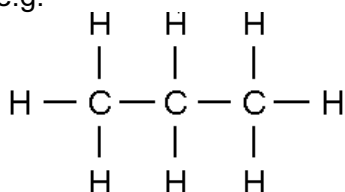
- 3 (a) combustion/burning, of (fossil) fuels/coal;
sulfur dioxide produced;
(which) reacts with/dissolves in, water (in atmosphere); [max 2]

- (b) eutrophication;
increased growth of algae;
blocks light to plants deeper down;
algae/plants, die;
bacteria feed on them/bacteria population increases;
bacteria use oxygen;
removal of oxygen kills fish; [max 3]

- (c) reference to (less) photosynthesis;
so less carbon dioxide removed;
trees burned;
producing carbon dioxide; [max 2]

[Total: 7]

- 4 (a) chain of three carbon atoms joined by single bonds;
eight hydrogen atoms correctly bonded to carbon;
e.g. [2]



- (b) boiling range/point is lower at **B** than **C**;
because (mean) intermolecular attraction lower;
so less (heat) energy needed to separate molecules/boil the mixture;
intermolecular attraction is lower for smaller molecules; [max 3]

- (c) (i) too reactive/compounds much more stable; [1]

- (ii) sodium atoms lose one electron/outer shell electron/become 2.8;
chlorine atoms gain one electron/complete their outer shell become 2.8.8; [2]

[Total: 8]

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- 5 (a) (i) calcium; [1]
- (ii) water; [1]
- (iii) has more calcium;
for, teeth/bones; [2]
- (iv) calcium;
can be absorbed as it is/idea that it consists of small particles; [2]
- (b) (i) to speed up the process;
ref. enzymes;
idea of enzymes working faster at this temperature; [max 2]
- (ii) slows enzymes working/to keep it fresh; [1]
- (iii) acid produced; [1]

[Total: 10]

- 6 (a) (i) work = force $\times$ distance;
Y's work is 100 J and X's work is 120 J;
(so X does the most work) [2]
- (ii) (worker X)
reference to power = work/time;
(so worker X uses more power) [1]
- (iii) (density =) mass/volume;
= 5000/5500 = 0.91 (g/cm³); [2]
- (b) (i) working;
288 m; [2]
- (ii) 240 s; [1]
- (iii) boy C (no mark)
line on graph goes down so speed was changing/owtte ; [1]
(answer must show that the graph has been used)

[Total: 9]

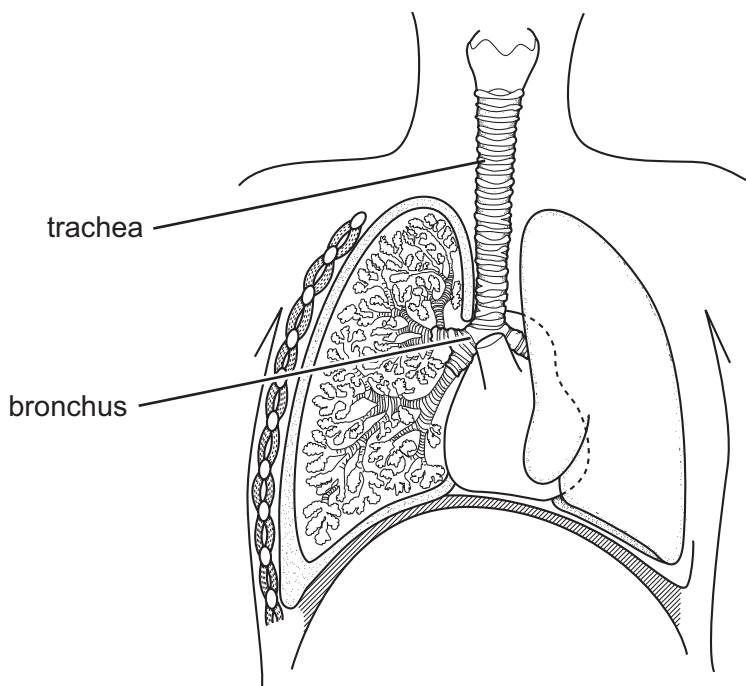
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- 7 (a) carbon dioxide;
limewater reacts with carbon dioxide/limewater is the test reagent for CO₂; [2]
- (b) (i) X shown clearly on graph at 2 min; [1]
- (ii) decrease of;
7 °C; [2]
(–7 °C scores both)
- (iii) (reaction is) endothermic/temperature (of the mixture) decreases;
thermal/heat/kinetic energy converted to (internal) chemical energy; [2]
- (c) sodium ion is Na⁺;
charges of ions must balance;
so hydrogencarbonate is HCO₃[–]; [3]

[Total: 10]

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8 (a)



[2]

- (b)** large surface area;
good blood supply;
thin wall;
moist surface;

[max 2]

- (c)** mucus traps, bacteria/pathogens/dust/particles;
cilia sweep mucus, upwards/away from lungs/to throat;

[2]

- (d) (i)** 3, 4 and 5 ;

[1]

- (ii)** ref. to bronchitis/inflammation in airways;
(because) more mucus produced/damaged cilia unable to remove
mucus (as efficiently);
in which bacteria breed;
ref. to named smoking-induced cancer e.g. lung, throat;
ref. to emphysema/breakdown of alveolar walls;
so gas exchange less efficient/difficult to get enough oxygen;
(allow other correct health-related conditions or consequences of smoking)

[max 3]

[Total: 10]

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- 9 (a) All symbols correct;
Ammeter in series and voltmeter in parallel;
Everything else correct; [3]
- (b) $V = IR$;
 $R = 0.3/0.5 = 0.6 \Omega$; [2]
- (c) Metals contract when cold;
If cables put up tight in summer/when warm, cables could snap or pylons could be
damaged when temperature falls/in winter; [2]

[Total: 7]