

MARK SCHEME for the October/November 2012 series

0653 COMBINED SCIENCE

0653/33

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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Page 2	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0653	33

- 1 (a) (i) two complete sets of chromosomes / 23 pairs / 46 chromosomes ; [1]
- (ii) fertilisation ; [1]
- (b) (i) A ;
D ; [2]
- (ii) it has petals ;
stigma is enclosed / inside petals ;
anthers / stamens are enclosed / inside petals / not dangling outside petals ;
so wind cannot reach them / wind cannot blow away pollen ;
so insect must crawl past, anther / stigma, to reach nectar ; [max 3]
- (c) (lettuce) seeds need oxygen (for germination) ;
(lettuce) seeds need water (for germination) ;
(lettuce) seeds do not need light (for germination) ; [3]
(max 2 marks if germination not mentioned)

[Total: 10]

- 2 (a) ions separated ;
randomly spread throughout the solution ; [2]
- (b) metal atoms form ions by losing electrons / outer shell electrons ;
calcium ions have 2 more protons than there are electrons ;
sodium ions have 1 more proton than there are electrons ; [3]
(accept numerical answers based on atomic numbers)
- (c) Na_2CO_3 ;
reference to charge balance ; [2]

[Total: 7]

- 3 (a) A – constant speed, and B – (constant) acceleration ; [1]
- (b) (i) work done = force \times distance ;
reference to $20 \times 90 = 1800 \text{ (m)}$;
 $= 1000 \times 1800 = 1\,800\,000 \text{ J}$; [max 3]
- (ii) power = work/time or power = energy/time ;
 $1\,800\,000 / 90 = 20\,000 \text{ W}$; [2]
- (c) (acceleration = change in speed / time) = $33 / 11$;
 $= 3 \text{ m/s}^2$; [2]

[Total: 8]

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0653	33

- 4 (a) (i) any number above 20 000 Hz ; [1]
- (ii) longitudinal ; [1]
- (b) (i) more drinking attempts from smooth than rough ;
use of figures / almost no attempts from rough ; [2]
- (ii) reference to water having a smooth surface ;
sound waves scattered in many directions from a rough surface ;
bats receive fewer echoes from a smooth surface ; [max 2]
- (c) fertiliser causes growth of algae / plants ;
which shade out other plants / plants die ;
bacteria feed on dead plants / increase in bacterial growth ;
bacteria use oxygen (for respiration) ;
fish die from lack of oxygen ; [max 3]
- [Total: 9]**
- 5 (a) diagram shows close packed regular pattern of spheres ;
including a few with a different diameter ;
idea that different sized atoms make it more difficult for atoms to move with
respect to one another ;
when a force is applied ; [max 3]
- (b) $\text{Cu}_2\text{S} + \text{O}_2 \longrightarrow 2\text{Cu} + \text{SO}_2$; [1]
- (c) (i) cathode is the negative electrode ;
attracts positive (copper) ions / attractive force between opposite charges ; [2]
- (ii) (copper) ions gain electrons ;
copper ions are discharged / gain two electrons / $\text{Cu}^{2+} + 2\text{e}^- \longrightarrow \text{Cu}$;
copper atoms join together / bond to the steel spoon ; [3]
- [Total: 9]**

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0653	33

- 6 (a) heat ;
kinetic ; [2]
- (b) (i) faster-moving more energetic particles ;
escape from surface ;
able to overcome attractive forces of other particles ; [max 2]
- (ii) lowers average energy of the remaining particles in the
liquid/evaporated particles take heat energy away from the liquid ; [1]
- (iii) reference to conduction ;
particles nearest heater (element) gain energy and vibrate more ;
vibration passes from particle to particle (through the metal) ; [2]
- (c) solid – particles touching and regular arrangement ;
liquid – most particles touching and random arrangement ; [2]
- (d) efficiency = useful energy out/energy in ;
OR
the fraction of input energy which is transferred to useful energy/owtte ; [max 1]
- [Total: 10]**

- 7 (a) (i) **A** incisor/canine ;
B molar/premolar ; [2]
- (ii) crush/grind ;
increase surface area ;
idea of better access for enzymes ; [max 2]
- (b) (i) mouth/small intestine/duodenum/ileum ; [1]
- (ii) small intestine/duodenum/ileum ; [1]
- (c) pH7 is optimum/enzyme more active at pH 7 than pH 5 ;
shape of enzyme is altered at pH 5 ;
so substrate cannot fit into active site ;
reference to denaturation ; [max 3]
- [Total: 9]**

Page 5	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0653	33

- 8 (a) (i) nucleus and 6 protons and 6 neutrons indicated ;
two electron shells with 2,4 configuration ; [2]
- (ii) **P, Q, S** ;
made of only one type of atom ;
- R** ;
made of different atoms (bonded) ; [4]
- (b) (i) (physical)
only changes of state involved / no new compounds produced ; [1]
- (ii) gasoline has larger molecules ;
larger molecules have greater attractive forces between themselves ;
so more energy needed to separate molecules ; [max 2]
- (c) gasoline burns to produce carbon dioxide which is linked to greenhouse effect / climate change ;
gasoline burns to produce pollutants such as carbon monoxide / other named pollutants which have adverse effects on health ;
hydrogen waste product is non-polluting water ; [3]
- [Total: 12]**

- 9 (a) (i) 3 ; [1]
- (ii) correct symbol **and** in parallel with battery ; [1]
- (iii) $R = V/I$;
 $= 6/0.3 = 20\ \Omega$; [2]
- (b) (i) angle of incidence and angle of reflection ; [1]
- (ii) 45° ; [1]
- [Total: 6]**