

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

0653 COMBINED SCIENCE

0653/33

Paper 3 (Extended Theory), maximum raw mark 80

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- 1 (a) (i) two complete sets of chromosomes/23 pairs/46 chromosomes ;
(ii) fertilisation ;
- (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]**

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- 4 (a) (i) any number above 20 000 Hz ;
(ii) longitudinal ;
- (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]

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- 6 (a) heat ;
kinetic ;
- (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]

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- 8 (a) (i) nucleus and 6 protons and 6 neutrons indicated ;
two electron shells with 2,4 configuration ;
- (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]