

**MARK SCHEME for the May/June 2014 series**

**0653 COMBINED SCIENCE**

**0653/32**

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) (speed =) distance / time ;  
=  $5/0.2 = 25$  (m/s) ; [2]
- (ii)  $25 \text{ m/s} = 25 \times 3600 \text{ m/h} (=90\,000 \text{ m/h})$  ;  
=  $90 \text{ km/h}$  (which breaks the  $80 \text{ km/h}$  speed limit) ; [2]
- (b) (i)  $KE = \frac{1}{2}mv^2$  ;  
=  $\frac{1}{2} \times 1600 \times 10 \times 10 = 80\,000$  (J) ; [2]
- (ii) energy conservation indicated ;  
conversion to other forms of energy (mainly to heat) ; [2]
- (c)  $(v =) f \lambda$  ;  
=  $200 \times 1.6 = 320$  (m/s) ; [2]

[Total: 10]

- 2 (a)  $O_2$  / (allow oxygen if no balancing attempted) ;  
6 in front of  $CO_2$  and  $O_2$  ; [2]
- (b) (i) aids buoyancy / helps it to float ; [1]
- (ii) root hairs (increase surface area to) absorb (more) water / mineral ions ;  
(not needed as) roots immersed in / surrounded by water ; [2]
- (c) (i) would die / not thrive due to lack of light / reduced photosynthesis ; [1]
- (ii) would decrease ;  
due to respiration of bacteria (feeding on dead plants) / reduced photosynthesis of  
submerged plants so less oxygen released ; [2]
- (iii) would suffocate / die due to lack of oxygen ; [1]

[Total: 9]

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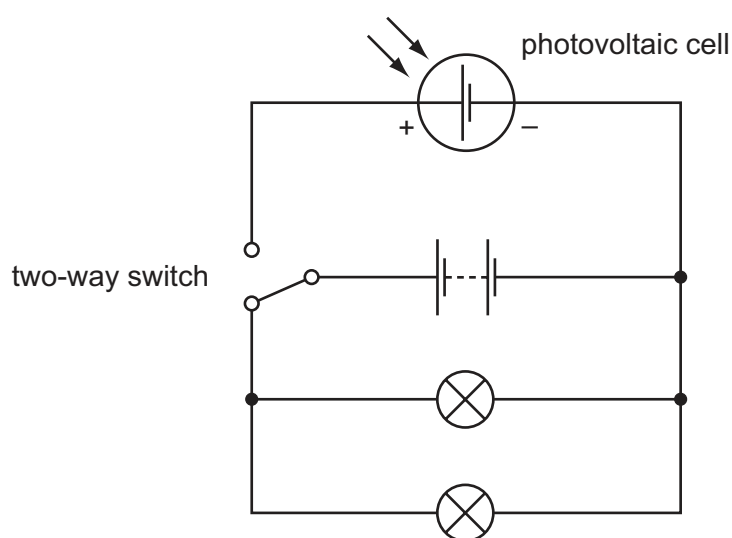
- 3 (a) brass is less malleable than copper/ora ;  
structure / pattern is disrupted ;  
more difficult for (layers of) atoms to slide over each other ; [max 2]
- (b) (i) salt ; [1]
- (ii)  $\text{CuO} + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{H}_2\text{O}$   
formulae ;  
balancing (consequential on correct formulae) ; [2]
- (c)  $\text{Cu}_2\text{O}$  ;  
clear reference to the need for balance of ionic charges ; [2]
- [Total: 7]**
- 4 (a) (i) running ;  
89 ; [2]
- (ii) the pulse (rate) increases as activity increases ; [1]
- (b) respiration ;  
glucose ;  
carbon dioxide ;  
faster ; [4]
- [Total: 7]**
- 5 (a) (i) elements become less metallic (from Group 1 to 0/left to right) ; [1]
- (ii) metallic atoms have fewer outer / valence electrons / owtte ; [1]
- (b) (i) any value in the range 20 to 55 °C ;  
more vigorous reaction than potassium in water / explosion ; [2]
- (ii) melting points decrease down the Table / Group ;  
reaction becomes more vigorous down the Table / Group ; [2]
- (c) (i) eight electrons in outer shell of sodium ion ;  
eight electrons in outer shell of chloride ion ; [2]
- (ii) sodium atom loses an electron ;  
chlorine atom gains an electron ; [2]  
([max 1] if atom not given at least once)
- (iii) (strong) force of attraction between positive and negative ions ; [1]
- [Total 11]**

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- 6 (a) the transfer of pollen from anther to stigma ; [1]
- (b) (i) large/feathery/large surface area (to collect pollen) ; [1]
- (ii) hanging out of flower (to release pollen into air) ; [1]
- (c) (X)  
sculptured/rough surface to stick to insect's body ; [1]

[Total: 4]

7 (a)



- complete circuit and two lamp symbols ;  
correct parallel arrangement ; [2]
- (b) electrical energy, light energy ; (both required, in this order) [1]
- (c) (i) (power =)  $V \times I$  ;  
 $= 3 \times 0.6 = 1.8$  ; W/watts ; [3]
- (ii) lamps are dimmer ;  
p.d./voltage across each bulb now only 1.5V/half ;  
current through each lamp is reduced ;  
one lamp breaks the other goes out ; [max 2]

[Total: 8]

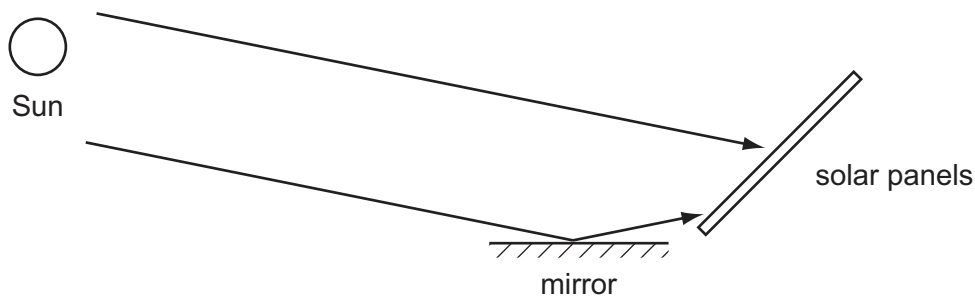
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- 8 (a) pH increases (as contents become less acidic) ;  
reference to the neutralisation reaction ; [2]
- (b) (i) (gas) syringe / measuring cylinder inverted in trough of water in a practical arrangement ;  
measuring apparatus labelled ;  
calibration indicated ; [max 2]
- (ii) rate of reaction decreases ;  
(because) concentration of acid / surface area / size of tablet decreases ;  
reaction goes to completion (when graph is horizontal) ;  
(because) a reactant is used up ; [max 2]
- (iii) steeper initial gradient ;  
same final volume ; [2]

**[Total: 8]**

- 9 (a) (i) molecules in gas (bubbles) too far apart to transmit by vibrating against each other/owtte ; [1]
- (ii) prevents (heat loss by) convection (of air in the gap) ; [1]
- (b) a time in the range 05.00 to 06.00 ; [1]
- (c) white ;  
poor emitter of radiant energy ; [2]

(d) (i)



any direct ray + ray reflected from mirror to solar panel (both required) ;  
angle of incidence = angle of reflection ; [2]

(ii)

gamma rays		ultra-violet	visible light	infra-red	microwave	
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infra-red in correct place ;  
visible in correct place ; [2]  
([max 1] if positions reversed)

**[Total: 9]**

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10 (a) a protein ;  
that functions as a (biological) catalyst ; [2]

(b)  $46 \pm 1^{\circ}\text{C}$  ; [1]

(c) (i) rate increases ;  
enzyme and substrate have more kinetic energy / molecules move faster ;  
more frequent collisions (between enzyme and substrate) ; max [2]

(ii) rate decreases ;  
enzyme becomes denatured ;  
substrate no longer fits active site / owtte ; max[2]

**[Total: 7]**