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**COMBINED SCIENCE**

**0653/31**

Paper 3 Extended Theory

**October/November 2016**

MARK SCHEME

Maximum Mark: 80

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**Published**

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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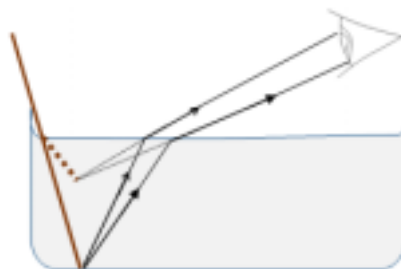
Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE<sup>®</sup>, Cambridge International A and AS Level components and some Cambridge O Level components.

Page 2	Mark Scheme	Syllabus	Paper
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- 1 (a) (i) light/radiation (energy) ;  
kinetic (energy) ; [2]
- (ii) (average) speed = distance/time =  $9/12 = 0.75$  (m/s) ; [1]
- (b) (i) 0.9 (m/s) ; [1]
- (ii) straight line – **constant** acceleration ;  
curved line – **not constant** acceleration/deceleration ; [2]
- (c) (i) work done =  $mgh = 10 \times 10 \times 6$  ;  
= 600 (J) ; [2]
- (ii) power = energy transferred/time taken ;  
=  $600/120 = 5$  (W) [2]
- 2 (a) neutrons 12 ;  
electrons 11 ; [2]
- (b) 2,8,1 ; [1]
- (c) same (number) ; [1]
- (d) (i) loss of **one** electron ; [1]
- (ii) Neon/Ne ; [1]
- (e) Li (actual 180 °C) 100 – 200 °C ;  
Cs (actual 28.5 °C) 21 – 35 °C ; [2]
- (f) NaCl is a compound/strong forces between ions/particles ;  
NaCl solution is a mixture/weak forces between water and ions/NaCl ; [2]

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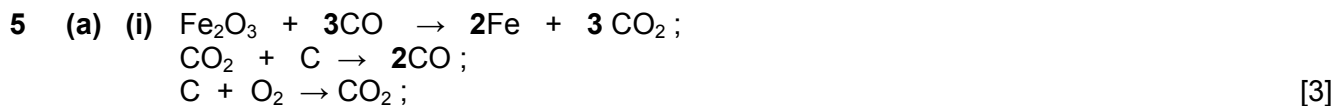
- 3 (a) geotropism/geotropic ; [1]
- (b) auxins ;  
(produced) at tip of seedling ;  
gather on side of seedling away from light ;  
cause more cell elongation on dark side ; [3]
- (c) (i) the number of germinating seeds increases as the pH increases ;  
the idea that low pH shows greater acidity ;  
use of data to support description; [2]
- (ii) acid denatures the enzymes (needed for germination)/owtte ; [1]
- (iii)  $(3/20 \times 100 =) 15 (\%)$  ; [1]
- (d) (i) reference to sulfur dioxide / nitrogen oxides ;  
*one from*  
description of process causing emission of polluting gases ;  
description of mixing / dissolving of gases in rainwater ; [max 2]
- (ii) acid rain reduces germination / growth / causes crop to die / avp ; [1]
- 4 (a) (i) evaporation / molecules break free (from surface) ;  
(thermal energy from Sun causes) water molecules to move faster / gain more K.E. ;  
(more) molecules moving fast enough / have enough energy to escape surface ; [3]
- (ii) paint trough white / polished metal trough / other reasonable suggestion ; [1]
- (b) (i) refraction ; [1]
- (ii) two diverging rays from same point on stick to the surface ; [max 3]  
at least one ray refracted (to eye) ;  
refracted rays diverge ;  
rays to eye projected back and converge to show the equivalent point on the image ;



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- (c) sound (waves for speech and hearing) ;  
description of sound waves – need for a medium / description of compression and rarefaction / longitudinal / any other correct ;  
microwaves (between mobile phones) ;  
description of microwaves – e / m radiation / no need for medium / transverse / any other correct ;

[max 3]



[3]

- (ii)  $\text{CO}_2$  / carbon dioxide ;  
forms CO / carbon monoxide / loses oxygen ;  
**or**  
 $\text{Fe}_2\text{O}_3$  / iron (III) oxide / iron oxide /  $\text{Fe}^{3+}$  / iron ions ;  
forms Fe / iron / loses oxygen / (ions) gain electrons ;

[2]

- (b) (i) aluminium is more reactive than carbon ;

[1]

- (ii) (ions) must be mobile / able to move ;

[1]

- (iii) ( $\text{Al}^{3+}$ ) gains (3 electrons) and ( $\text{O}^{2-}$ ) loses (2 electrons) ;

[1]

- (c) (i) (aluminium) lighter / lightweight / less dense / resists corrosion better ;

[1]

- (ii) (alloys) stronger (than pure Al) ;

[1]

- 6 (a) (i)  $48^\circ\text{C}$  ;

[1]

- (ii) the activity decreases at higher temperatures ;

[1]

- (b) (i) growth / repair ;

[1]

- (ii) vitamins / named vitamin ;  
prevent diseases / named disease / role of named vitamin ;

[2]

- (iii) (milk B)  
it contains less fat ;

[1]

- (c) prevents constipation ;

[1]

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- 7 (a) (i)  $1.5 + 0.5 + 0.6 = 2.6$  (V) ; [1]
- (ii)  $R = V \div I / 0.5 \div 0.3$  ;  
 $= 1.67 / 1.7$  (ohms) ; [2]
- (iii) power =  $V \times I$  ;  
 $= 2.6 \times 0.3 = 0.78 / 0.8$  (W) ; [2]
- (b) if in parallel, lamp **would light even if motor not turning** / owtte ; [1]
- 8 (a) (i) petroleum ; [1]
- (ii) boiling point ; [1]
- (b) (i)  $C_3H_6$  ; [1]
- (ii) ethene ; [1]
- (iii) test bromine / bromine water ;  
 $C_3H_8$  no change / stays orange and  $C_2H_4$  (orange) to colourless ; [2]
- (c) (octane +) oxygen  $\rightarrow$  carbon dioxide + water ; [1]
- 9 (a) umbilical cord ;  
an artery ;  
placenta ;  
oxygen ; [4]
- (b) (i) sexual intercourse ;  
**sharing** needles ;  
blood transfusions ;  
from mother to baby at birth ;  
from mother to baby during breast feeding ;  
avp ; [max 2]
- (ii) reduces immunity / makes a person more susceptible to disease ;  
attacks white (blood) cells ; [max 2]