

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0652 PHYSICAL SCIENCE

0652/31

Paper 3 (Extended Theory), maximum raw mark 80

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- 1 (a) 1 600 000 (N); [1]
- (b) (i) (2 000 000 – 1 600 000 =) 400 000 (N); [1]
- (ii) Use of ($a = F/m =$) 400 000 / 160 000 ; 1
 2.5 ; 1
 m s^{-2} ; 1 [3]
- (c) (Fuel burnt so) mass / weight decreases / gravity gets less / air resistance decreases (as rocket rises); [1]

[Total: 6]

- 2 (a) sodium chloride ;
 nitric acid ;
 magnesium hydroxide / magnesium oxide / magnesium carbonate /
 magnesium bicarbonate / magnesium hydrogencarbonate ; [3]
- (b) $2\text{HCl} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
 M1 correct formulae ;
 M2 correct balancing of a correct equation ; [2]
- (c) amphoteric ; [1]
- (d) (i) $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$;
 Ignore: spectator ions but must be correct ions and must balance [1]
- (ii) (hydroxide ion of sodium hydroxide)
 accepts proton / hydrogen ion / H^+ ;
 (and so it is a base) [1]

[Total: 8]

- 3 (a) copper best, iron worst ; 1
 brass better conductor than aluminium ; 1 [2]
- (b) (i) IR / infra-red / radiation ; [1]
- (ii) 19–31 (inclusive) ; [1]
- (iii) black is a (better) absorber (of radiation than silver) / silver is a (better) reflector ; [1]

[Total: 5]

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4	(a) cracking ; using a catalyst and reference to temperature ; OR <u>high</u> temperatures and reference to pressure ;	1 1 [2]
	(b) add bromine (water) ; <i>ethane</i> : no change / red or orange colour remains AND <i>ethene</i> : decolourises (the bromine water) ;	1 1 [2]
	(c) addition ; polymerisation ;	1 1 [2]
	(d) RFM ethene 28 or RFM ethanol 46 or 1:1 mole ratio identified ; (mass ethanol =) 46/28 ; 1.6(kg) ;	1 1 1 [3]
		[Total: 9]
5	(a) angle of refraction correctly marked ;	[1]
	(b) $(n =) \sin i / \sin r$ OR $\sin 16 / \sin 11$; 1.44(457 ...)	1 1 [2]
	(c) (i) Point marked, on line between centre of eye and beetle and further from lens than beetle ;	[1]
	(ii) upright ; enlarged ; virtual ;	1 1 1 [3]
		[Total: 7]

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- 6 (a) (i) (copper is) best/good (electrical) conductor ; [1]
- (ii) (aluminium is) lowest/low density ; [1]
- (b) (i) makes it strong ; [1]
- (ii) *Any 4 from:*
For pure metal:
 diagram and/or description of positive ions ;
 in sea of electrons ;
- For alloy:*
 ions of added metals different size to (aluminium ions) ;
 layers cannot slide/less easy to deform (lattice) ;
- In a pure metal:*
 layers can slide in a pure metal/or layers cannot slide as easily in an alloy ; [4]
- (c) (i) (aluminium has protective/waterproof) oxide layer ; [1]
- (ii) zinc is more reactive (than iron)/zinc reacts before iron ; [1]

[Total: 9]

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- 7 (a) energy given or supplied (by the battery) OR (total) work done in (complete) circuit ; 1
per unit charge ; 1 [2]
- (b) (i) Use of $(q = It) = 0.24 \times 5 \times 60 ;$ 1
72 ; 1
C or coulomb ; 1 [3]
- (ii) Use of $(E = Vq \text{ or } VIt) = 4.8 \times 72 ;$ 1
346 (J) ; 1 [2]
- (iii) (battery emf – potential drop across resistor = $6.0 - 4.8 =$)
1.2 (V) ; 1 [1]
- (iv) Use of $R = V/I (=1.2/0.24) ;$ 1
5.0 (Ω) ; 1 [2]
- (c) (i) either recognition that $2 \times$ length leads to $2 \times$ resistance OR $\frac{1}{2} \times$ diameter
leads to $4 \times$ resistance ; 1
 $(r = 5.0 \times 2 \times 4 =) 40.0 (\Omega) ;$ 1 [2]
- (ii) less ; 1
good reason, example:
current less thus IR less, larger share of voltage across (resistance) wire ; 1 [2]
- [Total: 14]**
- 8 (a) (concentration of) nitrogen oxides and carbon dioxide increased (with time) ; 1
Quantitative interpretation comment: e.g. percentage increase greater for
NO_x than CO₂ ; 1 [2]
- (b) reduce /stop increase (in nitrogen oxides) ; 1
catalytic converters change nitrogen oxide to nitrogen ; 1 [2]
- (c) *Any two from:*
carbon monoxide ;
lead compounds ;
carbon particulates/soot ;
unburned hydrocarbons ;
sulfur oxide(s) or dioxide or trioxide /SO_x/SO₂/SO₃
(volatile) organic compounds/VOC ; [2]

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- (d) Evidence of 114 e.g. $12 \times 8 + 18$ (allow: 228) ; 1
 1000/114 or 8.77 (moles of octane) ; 1
 2:16 or 1:8 mole ratio ; 1
 ($8.77 \times 8 = 70.2$ moles 1 mole = 24 dm^3
 $24 \times 70.$) = 1684/1680 ; 1 [4]

[Total: 10]

- 9 (a) (i) deflection of the voltmeter needle/there is a reading on voltmeter/emf induced ; 1
 *(needle) goes back again ; 1 [2]
- (ii) deflection in the opposite direction ; [1]
- (iii) larger deflection ; [1]
- (iv) deflection (as in (ii)) ; [1]
- (b) current (in primary coil) has magnetic field 1
 OR magnetic field changes (when switch opened) ; 1
 field from primary coil links with secondary coil ; 1
 (changed magnetic field) produces a deflection (when switch initially opens) ; 1 [3]

[Total: 8]

- 10 (a) melting point increases ; 1
 colour becomes darker ; 1 [2]
- (b) *Any two from:*
 brown colour/the same (as for bromine) ;
 chlorine displaces iodine/iodine displaced ;
 chlorine more reactive ; [2]

[Total: 4]