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) $2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2$
M1 correct formulae ;
M2 correct balancing of a correct equation ; [2]

(c) amphoteric ; [1]

(d) **(i)** $H^+ + OH^- \rightarrow H_2O$;
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]

4 **(a)** cracking ; 1
using a catalyst and reference to temperature ;
OR
high temperatures and reference to pressure ; 1 [2]

(b) add bromine (water) ; 1
ethane: no change / red or orange colour remains
AND
ethene: decolourises (the bromine water) ; 1 [2]

(c) addition ; 1
polymerisation ; 1 [2]

(d) RFM ethene 28 or RFM ethanol 46 or 1:1 mole ratio identified ; 1
(mass ethanol =) 46 / 28 ; 1
1.6 (kg) ; 1 [3]

[**Total: 9]**

5 **(a)** angle of refraction correctly marked ; [1]

(b) (n =) sin i / sin r
OR sin 16 / sin 11 ; 1
1.44(457 ...) ; 1 [2]

(c) **(i)** Point marked, on line between centre of eye and beetle and further from lens than beetle ; [1]

(ii) upright ; 1
enlarged ; 1
virtual ; 1 [3]

[Total: 7]

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) <u>oxide layer</u> ; [1]

(ii) zinc is more reactive (than iron) / zinc reacts before iron ; [1]

[Total: 9]

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 ($q = I\,t$) = 0.24 × 5 × 60 ; 1
72 ; 1
C or coulomb ; 1 [3]

(ii) Use of ($E = V\,q$ *or* $V\,I\,t$) = 4.8 × 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 × length leads to 2 × resistance OR ½ × diameter leads to 4 × resistance ; 1
(r = 5.0 × 2 × 4 =) 40.0 (Ω) ; 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 NOx than CO_2 ; 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 / SOx / SO_2 / SO_3
(volatile) organic compounds / VOC ; [2]

(d) Evidence of 114 e.g. 12 × 8 + 18 (allow: 228) ; 1
1000 / 114 or 8.77 (moles of octane) **;** 1
2:16 or 1:8 mole ratio ; 1
(8.77 × 8 = 70.2 moles 1 mole = 24 dm^3
24 × 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 <u>opposite</u> direction ; [1]

(iii) <u>larger</u> deflection ; [1]

(iv) deflection (as in **(ii)**) ; [1]

(b) current (in primary coil) has magnetic field
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]