

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

## **MARK SCHEME for the October/November 2014 series**

### **0652 PHYSICAL SCIENCE**

**0652/31**

Paper 3 (Extended Theory), maximum raw mark 80

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- 1 (a) (i) exothermic ; [1]
- (ii) energy is taken in when bonds are broken/endothemic ;  
energy is given out when bonds are made/exothermic ;  
when energy from making bonds is more than energy from breaking bonds ; [3]
- (b) (i) natural gas ; [1]
- (ii) it is unreactive/it is an alkane/it is saturated/contains no (C to C) double bonds ; [1]
- [Total: 6]**
- 2 (a) (i) 5.4(N) ; [1]
- (ii) mass = weight/g or 5.4/9.8 (e.c.f. and accept 10 or 9.81) ;  
= 0.55 kg (0.54) ; [2]
- (b) immerse in a liquid/put fully in a liquid/(accept 500+ cm<sup>3</sup>) ;  
in a measuring cylinder (not beaker) ;  
volume = difference in readings ;  
**OR**  
fill a eureka can with liquid ;  
immerse stone ;  
volume displaced measured in measuring cylinder is used ; [max 3]
- (c) density = mass/volume or 0.55 (× 10<sup>3</sup>)/180 ;  
3.1 (g/cm<sup>3</sup>) (e.c.f.) ; [2]
- [Total: 8]**
- 3 (a) petrol/gases/short chains, demand is greater than supply, for longer chains/fuel oil/paraffin/naphtha more made than required ; [1]
- (b) (i) large long/named hydrocarbons/alkanes broken down ;  
using high temperature (400–800 C)/catalyst\*/high pressure (40–100 atm) ;  
to make alkenes/smaller or more useful hydrocarbons/alkenes/named/  
hydrogen ; [3]  
(\*zeolite/aluminium, alumino silicate/aluminium oxide/claypot)
- (ii) (larger hydrocarbons) with plentiful supply/suitable named hydrocarbon ;  
can be cracked to produce more useful/more in demand/petrol/gases/  
shorter chains/alkenes/less wasteful ; [2]

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(c) (i) (family of) compounds with similar properties same functional group  
 same general formula ;  
 physical properties increase down the series ;  
 differing by CH<sub>2</sub> ; [max 2]

(ii) has (carbon to carbon) double bond / unsaturated ; [1]

**[Total: 9]**

4 (a) the number of (complete) waves / wavefronts (passing a point) per unit time ; [1]

(b) (i) wavefronts spread from the gap getting wider ;  
 symmetrical semicircles / circular arcs good and centred on the gap (centre) ;  
 wavelength constant and equal to that before going through the gap ; [3]

(ii) diffraction ; [1]

(c) *similarity*: wavelength / frequency / speed ;  
*difference*: front flattened at centre ; [2]

**[Total: 7]**

5 (a) (i) 3 ; [1]

(ii) number of electrons (outer shell) = group number / same / both are three /  
 ORA ; (*allow: valence electrons for outer electrons*) [1]

(b) boiling point decreases down the group ;  
 density increases down the group ; [2]

(c) (i) (lattice / matrix) of positive ions / cations (**NOT** atoms) ;  
 in a sea of / free / delocalised / mobile electrons ; (*allow: cloud*) [2]

(ii) electrons are free / delocalised / mobile ;  
 (electrons) carry the charge / current / move in response to a p.d. ;  
 (*allow: conduct the charge / current*) [2]

(iii) boron and it has a low / poor conductivity (**NOT** is an insulator / doesn't  
 conduct) ; [1]

**[Total: 9]**

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- 6 (a) (resistance) increases when the current increases ;  
comment re evidence from graph e.g. current rises too slowly/ the ratio  $V/I$  increases ; [2]
- (b) (i) 3.1 (A) ; [1]
- (ii)  $I = P/V$  or  $= 12/3$  ;  
4 (A) ; [2]
- (iii) 7.1 (A) (e.c.f.) ; [1]
- (iv)  $R = V/I$  or  $3.0/7.1$  or use of  $(1/R = 1/r_1 + 1/r_2)$  ;  
 $= 0.42 (\Omega)$  (e.c.f.) ; [2]
- (v)  $Q = I t$  or  $7.1 \times 5 \times (60)$  ;  
 $= 2130 (C)$  (e.c.f.) ; [2]
- [Total: 10]**

- 7 (a) (i) eight electrons in second shell ;  
8 electrons in third shell ; [2]
- (ii)  $\text{Na}_2\text{S}$  ; [1]
- (b) carbon with 3 shared pairs, one with each hydrogen ;  
carbon with 1 shared pair with sulfur ;  
sulfur with one shared pair with hydrogen ; [3]
- [Total: 6]**

- 8 (a) 91 protons, 140 neutrons ; [1]
- (b) (i) nucleon numbers correct, 227 and 4 ;  
proton numbers correct, 89 and 2 ; [2]
- (ii) actinium/ Ac (e.c.f. from (b)(i)) [1]
- (c) (i) the time taken for the number of atoms/ nuclei of that isotope (in any sample of the isotope) to halve/ owtte ;  
(allow time taken for radioactivity/ activity/ count rate from that isotope to halve) (**NOT** time taken for half the sample/ isotope to decay) [1]
- (ii) time for activity to fall to  $1/8^{\text{th}} = 3$  half-lives ;  
 $3 \times 3.4 \times 10^3 = 10.2 \times 10^3$  (years) ; [2]
- [Total: 7]**

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- 9 (a) 0.89 (minimum of two significant figures) ;  
64 (accept 63.5 to 64.5) ;  
80 ; [3]
- (b) recognition that 248 (g) of ore gives 128 (g) of Cu (e.c.f. from (a)) / recognition that mole ratio = 1 : 1 ;  
5 tonnes produces  $5 \times 128/248$  or  $5 \times 0.52$  ;  
2.58 (tonnes) of copper ; [3]
- (c)  $2\text{Cu}_2\text{O} + \text{C} \rightarrow 4\text{Cu} + \text{CO}_2$  ;;  
OR  $\text{Cu}_2\text{O} + \text{C} \rightarrow 2\text{Cu} + \text{CO}$  ;;  
OR  $\text{Cu}_2\text{O} + \text{CO} \rightarrow 2\text{Cu} + \text{CO}_2$  ;;  
(1 mark for formulae, 1 mark for balance, accept multiples/submultiples) [max 2]
- (d) (electrical) wiring / cooking pans / roofing / jewellery / pipes / coins / making alloys ;  
good electric conductor / good heat conductor / low corrosion / ductile / malleable /  
low reactivity / shiny ; [2]
- [Total: 10]**
- 10 (a) elastic (potential) / strain (potential) ; [1]
- (b) (i)  $E_k = \frac{1}{2} m v^2$  ;  
 $= \frac{1}{2} \times 0.18 \times 0.76^2$  ;  
 $= 0.052 \text{ (J)}$  ; [3]
- (ii) mention of friction ;  
work is done against friction / energy is converted to thermal / sound energy /  
friction in gears or axles ; [2]
- [Total: 6]**
- 11 equal magnitude ;  
opposite charge / positive ; [2]
- [Total: 2]**