

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/ endothermic ;
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+ cm³) ;
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 (× 10³)/180 ;
3.1 (g/cm³) (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 CH₂ ; [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) Na_2S ; [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 5×0.52 ;
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 $\text{Cu}_2\text{O} + \text{CO} \rightarrow 2\text{Cu} + \text{CO}_2$;; [max 2]
(1 mark for formulae, 1 mark for balance, accept multiples/submultiples)
- (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]**