**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**Cambridge International General Certificate of Secondary Education**

## MARK SCHEME for the October/November 2014 series

# 0652 PHYSICAL SCIENCE

**0652/32** 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+ $cm^3$) ;
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 ($\times 10^3$)/180 ;
3.1 ($g/cm^3$) (e.c.f.) ; [2]

**[Total: 8]**

**3 (a)** petrol / gases / short chains, demand is greater than supply, for longer chains / fuel oil / paraffin / naptha 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]

**(c) (i)** (family of) compounds with similar properties same functional group
same general formula ;
physical properties increase down the series ;
differing by $CH_2$ ; [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 <u>decreases</u> down the group ;
density <u>increases</u> 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 <u>and</u> it has a low / poor conductivity (**NOT** is an insulator / doesn't
conduct) ; [1]

**[Total: 9]**

**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 <u>of that isotope</u> (in any sample of the isotope) to halve / owtte ;
*(allow time taken for radioactivity / activity / count rate from <u>that isotope</u> to halve)* (**NOT** time taken for half the sample / isotope to decay) [1]

**(ii)** time for activity to fall to $1/8^{th}$ = 3 half-lives ;
$3 \times 3.4 \times 10^3 = 10.2 \times 10^3$ (years) ; [2]

**[Total: 7]**

**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)** $2Cu_2O + C \rightarrow 4Cu + CO_2$ ;;
**OR** $Cu_2O + C \rightarrow 2Cu + CO$ ;;
**OR** $Cu_2O + CO \rightarrow 2Cu + CO_2$ ;; [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)** $E_k = ½ m v^2$ ;
$= ½ \times 0.18 \times 0.76^2$ ;
= 0.052 (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]**