

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

**MARK SCHEME for the May/June 2015 series**

**0654 CO-ORDINATED SCIENCES**

**0654/32**

Paper 3 (Extended Theory), maximum raw mark 120

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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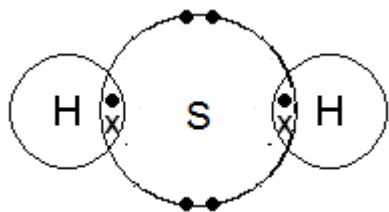
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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

- 1 (a) (i) mass is a measure of amount of matter in an object; [max 2]  
weight is the gravitational force pulling on the object;  
mass will be the same throughout the universe but weight will depend  
on gravitational field strength;
- (ii)  $180/18.4 = 9.78$  (N/kg); [1]
- (iii) (work =) force x distance ; [2]  
=  $20 \times 30 = 600$  (J);
- (iv) (potential energy =) mgh; [2]  
=  $18.4 \times 9.78 \times 3.0 = 539.9$  (J);  
(allow ecf from (ii))
- (b) force = mass x acceleration; [3]  
acceleration =  $\frac{4 \times 250\,000}{350\,000} = 2.86$ ;  
m/s<sup>2</sup>;
- [Total: 10]
- 2 (a) (i) (dilute) sulfuric acid ; [2]  
magnesium / magnesium oxide / magnesium carbonate /  
magnesium hydrogen carbonate / magnesium hydroxide;
- (ii) if Mg then hydrogen / H<sub>2</sub> (reject H) [1]  
if MgO / Mg(OH)<sub>2</sub> then water / H<sub>2</sub>O  
if MgCO<sub>3</sub> then carbon dioxide **and** water / CO<sub>2</sub> and H<sub>2</sub>O  
if Mg(HCO<sub>3</sub>)<sub>2</sub> then carbon dioxide **and** water / CO<sub>2</sub> and H<sub>2</sub>O;

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

- (b) hydrogen sulfide (H<sub>2</sub>S) [3]

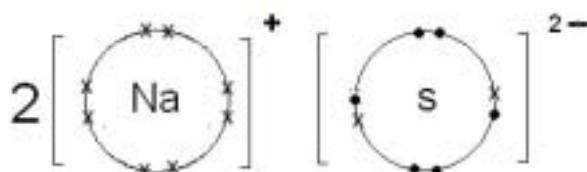


2 shared pairs;  
2 lone pairs;  
full outer shell for atoms shown and correct symbols;

- sodium sulfide (Na<sub>2</sub>S) [3]



OR



correct ionic charges;  
correct ratio of ions;  
correct number of electrons in each outer shell;

- (c) (i) hydrogen 4 [1]  
sulphur 3  
both required:

- (ii) state symbol (g) indicates gaseous state; [2]  
both sulfur/water are only gases at high temperature/owtte;

[Total: 12]

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

- 3 (a) (labels, from top left) [4]  
photosynthesis;  
respiration;  
respiration;  
combustion;
- (b) arrow from plants to animals; [1]
- (c) energy, is not recycled / does not circulate / has linear flow / ORA; [1]
- (d) (i) more photosynthesis (than respiration and decay) in spring/summer; [2]  
more decay/respiration (than photosynthesis) in autumn;
- (ii) less photosynthesis ; [2]  
which removes CO<sub>2</sub> (from atmosphere);
- (iii) combustion of fossil fuels increases atmospheric CO<sub>2</sub>; [max 2]  
combustion of wood balanced by (recent) photosynthesis;  
combustion of fossil fuels produces SO<sub>2</sub> / acid rain;

[Total: 12 marks]

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

4 (a)

[6]

description	element symbol(s)
it is a halogen that is more reactive than chlorine	F
it may be used as a catalyst in the Haber Process	Fe
its atoms have all electron shells filled	Ne
their atoms have four electron shells	K Fe Cu Br
they are good electrical conductors	Li K Fe Cu
they are transition elements	Fe Cu

1 mark for each completely correct box; ; ; ; ;

(b) (i)  $A_r\text{Zn} = 65$  ; [2]  
 $65 \times 0.2 = 13 \text{ g}$  ; (unit required)

(ii) the same number of particles / atoms / molecules ; [1]

[Total: 9]

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

- 5 (a) (i) 156–160 (cm) ; [1]  
(ii) 30 ; [1]
- (b) continuous; [1]
- (c) (i) different environments qualified / different diets / mutation / AVP ; [1]  
(ii) they have the same genotype / height depends (partly) on genes / genotype ; [1]
- (d) shows discontinuous variation / distinct categories ; [max 2]  
entirely genetic / not affected by environment ;  
limited number of phenotypes ;

[Total: 7 marks]

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

- 6 (a) (i) friction; [2]  
transfer of electrons / charges;
- (ii) (power =) energy / time; [2]  
 $= 24 \times 10^{-3} / 3 \times 10^{-5} = 800 \text{ (W)}$ ;
- (iii) power = voltage x current; [2]  
current =  $800 / 10\,000 = 0.08 \text{ (A)}$ ;  
(e.c.f. from (a)(ii))
- (b)  $1/R_T = 1/R_1 + 1/R_2$  or  $(R_T =) R_1 R_2 / R_1 + R_2$ ; [2]  
 $R_T = 1.5 \text{ (}\Omega\text{)}$ ;
- (c) (i) quieter; [1]
- (ii) transverse wave, oscillate / vibrate, at right angles to direction of movement of, [2]  
wave energy transfer;
- longitudinal wave, oscillate / vibrate, parallel to direction of movement of,  
wave / energy transfer;
- longitudinal waves have compressions and rarefactions / longitudinal waves need a  
medium;
- (d) (rotating) coil cuts magnetic field / experiences a changing magnetic field; [max 3]  
induces emf;  
slip rings conduct current / slip rings avoid wires tangling;  
emf / current, reverses every half turn;

[Total: 14]

- 7 G;  
B;  
E;  
C;

[Total: 4 marks]

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

8 (a) (% O in Earths crust is bigger) [max 2]  
 % O in air is 21% ;  
 % O in crust is  $100 - (27.7 + 8.1 + 5.0 + 12.6) = 46.6\%$  ;  
 use of bar chart ;

(b) (R) [max 2]  
 R (probably) is a solid ;  
 S is a gas ;  
 R is a giant structure ;

(c) (i) iron oxide + carbon monoxide  $\rightarrow$  iron + carbon dioxide ; ; [2]

(ii) (each ion) gains electrons ; [max 2]  
 (each gains) three electrons ;  
 converted from ions into atoms / ions are discharged ;  
 $Al^{3+} + 3e^{-} \rightarrow Al$  ; ;

[Total: 8]

9 (a) (i) compression – region of high pressure / particles are closer together / particles are more dense ; [1]  
 OR  
 rarefaction – region of low pressure / particles more spread out / particles less dense ;

(ii) particles closer together ; [2]  
 particles, pass on vibrations / collide, more quickly / time between collisions shorter ;

(b) evaporation can occur at any temperature / boiling only happens at the boiling point ; [max 2]  
 evaporation happens only at the surface / boiling happens throughout the liquid ;  
 boiling takes energy in (endothermic) to occur / evaporation lets only the molecules with the highest kinetic energy out ;  
 evaporation can occur using the internal energy of the system / while boiling requires an (external) source of heat ;  
 evaporation produces cooling / boiling does not produce cooling ;  
 evaporation is a slow process / boiling is a rapid process ;

(c) (i) B because most particles are touching / closely packed and randomly arranged ; [1]

(ii) C because particles are widely spaced and randomly arranged ; [1]

[Total: 7]



Page 9	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

- 10 (a) osmosis (allow: diffusion) ; [3]  
through partially permeable (cell) membrane ;  
down water potential gradient;
- (b) absorbs/intake of mineral ions/nitrate (ions)/magnesium (ions)/  
other named mineral ion ; [1]
- (c) creates large surface area ; [1]
- (d) leaves/stomata ; [1]
- (e) for photosynthesis ; [max 2]  
as part of cytoplasm/for growth ;  
support/turgor ;  
for transport (of ions/sugars) ;
- (f) because underground/no light ; [1]

[Total: 9 marks]

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

- 11 (a) (i) (alkene) [1]  
reference to the double bond / has the general formula  $C_nH_{2n}$ ;
- (ii) bromine is decolourised / orange to colourless ; [1]
- (b) (thermal / catalytic) cracking ; [4]  
(feedstock is) alkanes ;  
(alkanes) are heated / vaporised ;  
in presence of a catalyst / at high pressure ;
- (c) (i)  $M_r$  ethene =  $(2 \times 12) + (4 \times 1)$  ; [1]
- (ii) (addition) polymerisation occurs ;  
ethene molecules join to form (long) chains ;  
OR [2]  
correct symbol representation e.g.  
 $n C_2H_4 \rightarrow -(C_2H_4)_n-$  scores both marks
- (iii) many chains / polymer molecules are formed ;  
chains vary in length ; [2]

[Total: 11]

<b>Page 11</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge IGCSE – May/June 2015</b>	<b>0654</b>	<b>32</b>

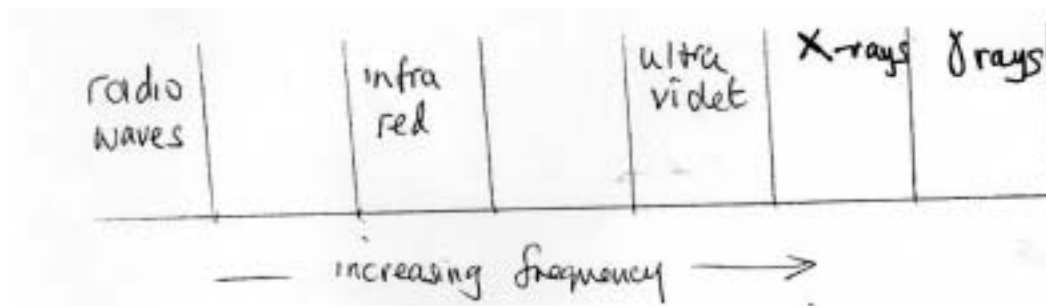
- 12 (a)** higher rate ; **[2]**  
not decreasing ;
- (b)** people more likely to suffer CHD as they get older ; **[max 1]**  
younger people more likely to die of other causes ;
- (c)** too much food/energy, leading to obesity ; **[max 2]**  
too much (saturated) fat ;  
too much salt ;
- (d)** differences in smoking rates ; **[max 2]**  
differences in stress ;  
different amounts of exercise ;  
genetic differences ;  
more / fewer deaths from other causes / differences in health care ;  
ref to differences in education ;
- (e)** different population sizes ; **[max 1]**

**[Total: 8 marks]**

Page 12	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2015	0654	32

13 (a) (i)

[2]



;;

(ii)  $3 \times 10^5$  (km/s) ;

[1]

(b) (i) **both** statements ticked ;  
It can pass through the human body.  
It is safer than  $\alpha$  or  $\beta$  radiation.

[1]

(ii) first point plotted ;  
2<sup>nd</sup> and third points plotted ;  
smooth curve not reaching axis ;

[3]

(c)

[2]

A bundle of optical fibres takes the light to an eyepiece lens	4
Light passes through a bundle of optical fibres into the patient's stomach	1
The doctor looks through the eye-piece lens to see the inside of the patient's stomach	5
The inside of the stomach reflects some of the light	2
The reflected light passes into a bundle of optical fibres	3

;;

[Total: 9]