

**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

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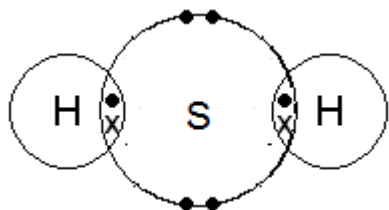
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- 1 (a) (i) mass is a measure of amount of matter in an object; [max 2]  
weight is the gravitational force pulling on the object;  
mass will be the same throughout the universe but weight will depend  
on gravitational field strength;
- (ii)  $180/18.4 = 9.78$  (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;

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

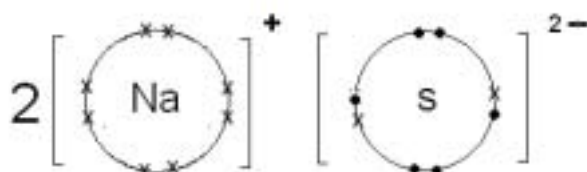


2 shared pairs;  
2 lone pairs;  
full outer shell for atoms shown and correct symbols;

- 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]

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- 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]**

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]

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- 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]

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- 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]

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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]



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- 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]**

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- 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]

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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 ;

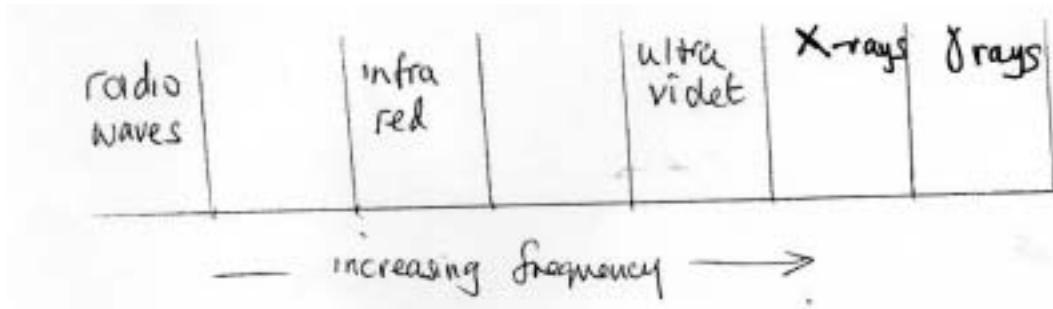
(d) differences in smoking rates ; [max 2]  
differences in stress ;  
different amounts of exercise ;  
genetic differences ;  
more / fewer deaths from other causes / differences in health care ;  
ref to differences in education ;

(e) different population sizes ; [max 1]

**[Total: 8 marks]**

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]