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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CAMBRIDGE
International Examinations

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 ;
= 20x 30 = 600 (J); **[2]**

(iv) (potential energy =) mgh;
= 18.4 x 9.78 x 3.0 = 539.9 (J); **[2]**
(allow ecf from (ii))

(b) force = mass x acceleration; **[3]**
acceleration = $\frac{4 \times 250\,000}{350\,000} = 2.86$;
m/s^2;

[Total: 10]

2 (a) (i) (dilute) sulfuric acid ; **[2]**
magnesium / magnesium oxide / magnesium carbonate /
magnesium hydrogen carbonate / magnesium hydroxide;

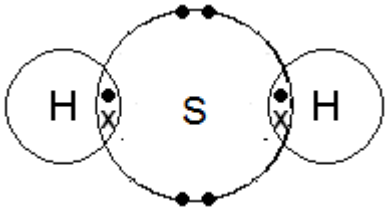
(ii) if Mg then hydrogen / H_2 (reject H) **[1]**

if MgO / $Mg(OH)_2$ then water / H_2O

if $MgCO_3$ then carbon dioxide **and** water / CO_2 and H_2O

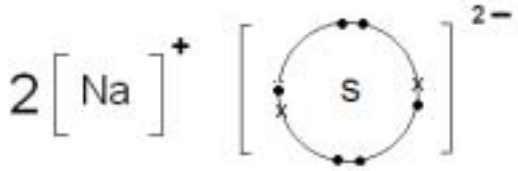
if $Mg(HCO_3)_2$ then carbon dioxide **and** water / CO_2 and H_2O;

(b) hydrogen sulfide **[3]**
(H_2S)

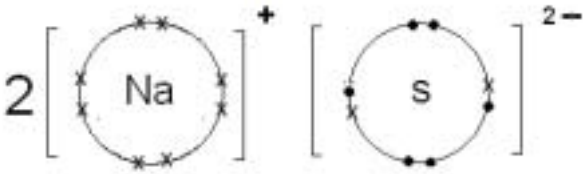


2 shared pairs;
2 lone pairs;
full outer shell for atoms shown and correct symbols;

sodium sulfide **[3]**
(Na_2S)



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]

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_2 (from atmosphere);

(iii) combustion of fossil fuels increases atmospheric CO_2; **[max 2]**
combustion of wood balanced by (recent) photosynthesis;
combustion of fossil fuels produces SO_2 / 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 Zn = 65 ; **[2]**
65 x 0.2 = 13 g ; (unit required)

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

[Total: 9]

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]

6 (a) (i) friction; **[2]**
transfer of electrons / charges;

(ii) (power =) energy / time; **[2]**
$= 24 \times 10^{-3} / 3 \times 10^{-5} = 800$ (W);

(iii) power = voltage x current; **[2]**
current = 800 / 10 000 = 0.08 (A);
(e.c.f. from (a)(ii))

(b) $1/R_T = 1/R_1 + 1/R_2$ or $(R_T =) R_1R_2/R_1 + R_2$; **[2]**
$R_T = 1.5\ (\Omega)$;

(c) (i) quieter; **[1]**

(ii) transverse wave, oscillate / vibrate, at right angles to direction of movement of, wave energy transfer; **[2]**

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]**
<u>induces</u> 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]

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 → 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 ;
particles, pass on vibrations / collide, more quickly / time between collisions shorter ; **[2]**

(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]

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]

11 (a) (i) (alkene)
reference to the double bond / has the general formula C_nH_{2n}; **[1]**

(ii) bromine is decolourised / orange to colourless ; **[1]**

(b) (thermal / catalytic) cracking ;
(feedstock is) alkanes ;
(alkanes) are heated / vaporised ;
in presence of a catalyst / at high pressure ; **[4]**

(c) (i) M_r ethene = (2 x 12) + (4 x 1) ; **[1]**

(ii) (addition) polymerisation occurs ;
ethene molecules join to form (long) chains ;
OR
correct symbol representation e.g.
n $C_2H_4 \rightarrow -(C_2H_4)_n-$ scores both marks **[2]**

(iii) many chains / polymer molecules are formed ;
chains vary in length ; **[2]**

[Total: 11]

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) 3×10^5 (km/s) ; **[1]**

(b) (i) **both** statements ticked ; **[1]**
It can pass through the human body.
It is safer than α or β radiation.

(ii) first point plotted ; **[3]**
2nd and third points plotted ;
smooth curve not reaching axis ;

(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]