Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/32**

Paper 3 Extended Theory **May/June 2016**

MARK SCHEME

Maximum Mark: 120

Published

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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

1 (a) (i) **C** ;
carbon dioxide ; [2]

(ii) **B** ;
copper is formed / copper ions are lost / solution loses colour / it is a displacement reaction ; [2]

(b) (i) (**B**)
reaction causes temperature increase ; [1]

(ii) (**C**)
reaction is endothermic / temperature decreases ;
because kinetic energy of molecules increases /
convers to chemical potential energy ; [2]

(iii) no change in temperature suggests no reaction ;
because copper is too unreactive
to displace hydrogen from dilute acid ; [2]

[Total: 9]

2 (a) (i) transpiration ; [1]

(ii) more stomata means faster transpiration,
because water loss occurs here ; [1]

(iii) less exposure to sunlight / lower temperature ;
therefore, less water loss ; [2]

(b) (i) 16.00 ;
17.00 ; [2]

(ii) similar pattern / correlated ;
water uptake lags behind water loss ;
appropriate comparison of water uptake and water loss ; [max 2]

(c) large surface area ;
thin / permeable ; [2]

[Total: 10]

3 (a) (i) (KE =) $\frac{1}{2}\ mv^2 / \frac{1}{2} \times 3.6 \times 10^5 \times (60 \times 60)$;
6.48×10^8 (J) ; [2]

(ii) (acceleration =) change in speed / time / 60 / 30 ;
60 / 30 = 2 (m/s^2) ; [2]

(b) kinetic and gravitational potential energy ; [1]

(c) speed is magnitude only but velocity is magnitude and direction ; [1]

(d) area 20×0.06 ;
(pressure =) force / area / $3.6 \times 10^6 / 20 \times 0.06$;
$= 3 \times 106$ (N / m^2) ; [3]

(e) increased airflow ;
increased temperature ;
larger surface area ;
low humidity ; [max 2]

(f) friction between fuel and pipe ;
fuel losses electrons to pipe ; [2]

[Total: 13]

4 **(a)** reference to helium being unreactive / greater reactivity of hydrogen ;
reference to safety / reducing fire risk ; [2]

(b) $3 \times$ carbon and $8 \times$ hydrogen ;
all single bonds and no other errors ; [2]

(c) reference to greater particle size / mass / surface area of propane ;
so greater intermolecular attractive forces in propane ;
so more thermal / heat energy required to separate propane molecules ; [max 2]

[Total: 6]

5 **(a)** **(i)** four ; [1]

(ii) tamarind monkey / insect / howler monkey / sloth ; [1]

(iii) energy losses at each stage ;
so not enough energy left at higher trophic levels ; [2]

(iv) decomposer ; [1]

(b) **(i)** carbon dioxide used for photosynthesis ;
less photosynthesis / less CO_2 absorbed ;
decomposition / combustion of trees produces CO_2 ; [max 2]

(ii) CO_2 produced by combustion, and not in construction ; [1]

[Total: 8]

6 **(a)** visible placed to the **left** of ultraviolet ; [1]

(b) **(i)** cancer / mutations ; [1]

(ii) gamma more penetrating ;
gamma has no charge, alpha has positive charge ;
gamma is a wave, alpha is a particle ;
gamma less ionising ; [max 1]

(c) two errors circled on diagram ;
two errors described ;; [3]

(d) (i) $v = f \times \lambda / 3 \times 10^8 / 4 \times 10^{14}$;
7.5×10^{-7} (m) ; [2]

(ii) 3×10^8 (m / s) (no mark)
all electromagnetic waves travel at the same speed ; [1]

[Total: 9]

7 (a) set point / steady state ;
change away causes a change towards / AW ; [2]

(b) (i) pancreas correctly labelled ; [1]

(ii) insulin ;
liver ;
glycogen ;
glucagon ; [4]

[Total: 7]

8 (a) (i) radiation ; [1]

(ii) nuclear fusion ; [1]

(iii) black surfaces are better absorbers of radiation than white surfaces / white surfaces are better reflectors of radiation than black surfaces ; [1]

(b) coil cuts magnetic field lines ;
coil experience a changing magnetic field ;
emf included in coil producing a current ;
emf / current reverses every half turn ;
slip rings prevent tangling of wires ; [max 3]

(c) (i) number of waves / vibrations per second
or number of waves passing a fixed point / second ; [1]

(ii) smaller amplitude and lower pitch ; [1]

(iii) compression – particles closer together – rarefaction further apart or
compression – region of high pressure – rarefaction region of low pressure ; [1]

[Total: 9]

9 (a) (i) 11 electrons / in shells / energy levels surrounding the nucleus ;
2, 8, 1 configuration ; [2]

(ii) same number of outer electrons / both have a single outer electron ; [1]

(b) sodium ions are attracted to the cathode ;
sodium ions gain an electron / are discharged ;
sodium ions converted to sodium atoms ;
correct equation ;; [max 2]

(c) (i) 8 to 14 ;
sodium hydroxide solution is alkaline ; [2]

(ii) $2Na + 2H_2O \rightarrow 2NaOH + H_2$;; [2]

(d) calculate M_r of lithium hydroxide = 24 ;
stoichiometry /
use of equation to show 2000 moles lithium hydroxide needed ;
calculate mass of 2000 moles lithium hydroxide
= 2000 × 24 g / 48 000 g ; [3]

[Total: 12]

10 (a) change in a gene / chromosome ;
any detail ; [2]

(b) (i) P = Nn ;
Q = NN ;
or Nn ; [3]

(ii) CF children born to normal parents ;
so these parents must have carried the allele ;
e.g. G has normal parents / child of E has CF ; [max 2]

[Total: 7]

11 (a) (i) S_8 ; [1]

(ii) only one type of atom ; [1]

(b) (i) red / orange ;
solution is acidic / sulfur dioxide is acidic / non-metal oxides are acidic ; [2]

(ii) oxygen 21 and nitrogen 78 ; [1]

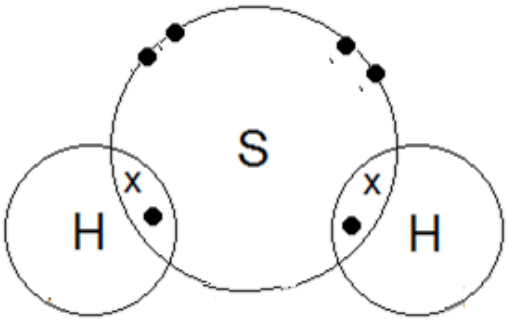
(iii) rate is greater (in oxygen) ; [1]

(iv) the idea that oxygen in air is diluted by other gases ;
collision frequency between oxygen and sulfur greater in pure oxygen ; [2]

(c) (i) vanadium oxide is the catalyst ;
but is not consumed / permanently changed ; [2]

(ii) concentrated sulfuric acid ; [1]

(d)



removes extraneous electron from both H atoms ;
includes only two lone pairs of electrons on S atom ; [2]

[Total: 13]

12 (a) all components present ;
in series circuit ;
all symbols correct ; [3]

(b) (charge =) current × time / = 0.7 × 20 × 60 ;
840 ;
C ; [3]

(c) use of $1/R_T = 1/R_1 + 1/R_2$;
$R_T = 12/4 = 3\ (\Omega)$; [2]

(d)

	in series	in parallel
the current through each resistor is the same	√	
the voltage across each resistor is the same		√

[1]

[Total: 9]

13 (a) more light at the top ;
for photosynthesis ; [2]

(b) (i) increased growth ;
due to more mineral ions ;
followed by decreased growth / death because all mineral ions used up / no light / outcompeted by algae ; [max 2]

(ii) increased numbers ;
because more dead matter ;
bacteria respire ; [max 2]

(iii) death, because of lack of oxygen ;
oxygen used by the bacteria / decomposers ; [2]

[Total: 8]