



CO-ORDINATED SCIENCES

0654/32

Paper 3 Extended Theory

May/June 2016

MARK SCHEME

Maximum Mark: 120

Published

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- 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 /
converts 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) $(KE =) \frac{1}{2} m v^2 / \frac{1}{2} \times 3.6 \times 10^5 \times (60 \times 60) ;$
 $6.48 \times 10^8 \text{ (J)} ;$ [2]
- (ii) (acceleration =) change in speed / time / 60 / 30 ;
 $60 / 30 = 2 \text{ (m/s}^2\text{)} ;$ [2]
- (b) kinetic and gravitational potential energy ; [1]
- (c) speed is magnitude only but velocity is magnitude and direction ; [1]

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(d) area 20×0.06 ;
 (pressure =) force/area/ $3.6 \times 10^6/20 \times 0.06$;
 $= 3 \times 10^6$ (N/m²) ; [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 CO₂ absorbed ;
 decomposition/combustion of trees produces CO₂ ; [max 2]

(ii) CO₂ 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]

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(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) (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 induced 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]

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- (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) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$;; [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
= $2000 \times 24 \text{ g} / 48\,000 \text{ g}$; [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]

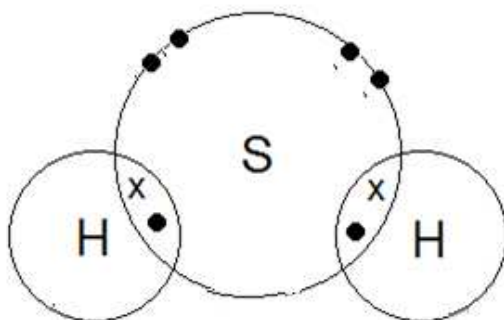
- 11 (a) (i) S_8 ; [1]

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

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- (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 \times time / = $0.7 \times 20 \times 60$;
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]