

MARK SCHEME for the May/June 2013 series

0654 CO-ORDINATED SCIENCES

0654/21

Paper 2 (Core 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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- 1 (a) (i) **B** ;
sum of protons and neutrons is 16 ; [2]
- (ii) **A and C** ;
proton number 1 shows hydrogen (so it has to be these two) ;
(isotopes) have same number of protons but different numbers of neutrons ; [max 2]
- (iii) numbers of protons and electrons are the same ;
protons positive electrons negative ;
charges (of protons and electrons) cancel ; [max 2]
- (b) (i) covalent ; [1]
- (ii) helium is inert/unreactive/stable/no need to bond (to become stable) ;
reference to complete outer shell ; [max 1]
- (iii) airships/balloons/other correct ; [1]
- (c) pop (test) indicates hydrogen (given off) ;
zinc reacts to displace hydrogen ;
zinc more reactive than hydrogen ; [max 2]
- [Total: 11]**

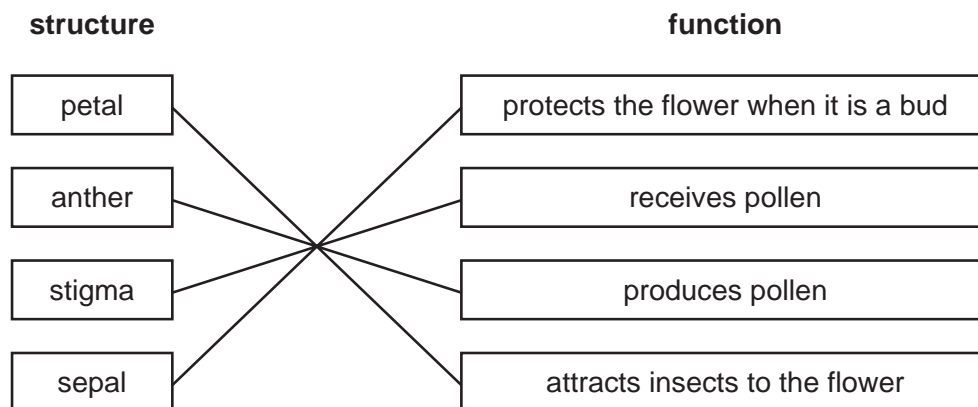
- 2 (a) gravity ; [1]
- (b) (distance =) speed \times time ;
 $= 1600 \times 0.2/2 = 160$ (m) ; [2]
- (c) (i) less fossil fuels used up ;
reduce global warming ;
no CO₂ emissions ;
no acid rain emissions ;
will not run out; [max 2]
- (ii) transfer of KE to PE as water moves up chamber ;
transfer of KE to air inside chamber ;
transfer of KE of air to KE of (rotation of) turbine ;
transfer of KE of turbine to KE of generator ;
transfer of KE of generator to electrical energy ; [max 2]

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- (d) (i) sea water ; [1]
(ii) evaporation ; [1]
(iii) freezing/solidification ; [1]

[Total: 10]

3 (a)



*all four correct for 3 marks
two or three correct for 2 marks
one correct for 1 mark ;;;*

[3]

- (b) water ;
suitable temperature/warmth ;
air/oxygen

[3]

- (c) no gametes ;
no fertilisation ;
no zygote ;
no (genetic) variation ;
only one parent/plant ;
no meiosis ;

[max 2]

[Total: 8]

Page 4	Mark Scheme	Syllabus	Paper
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- 4 (a) (i) chain of two carbon atoms joined by single bond ;
only six hydrogen atoms correctly bonded to carbon ; [2]
- (ii) methane ; [1]
- (iii) colour change orange to colourless ; [1]
- (b) (i) fractional distillation / fractionation; [1]
- (ii) carbon dioxide;
water (ignore vapour) ; [2]
- (c) (i) too reactive / compounds much more stable ; [1]
- (ii) electrons are transferred ;
both get a full shell;
sodium atoms lose (one) electron / outer shell electron / become 2,8 ;
chlorine atoms gain (one) electron / complete outer shell / become 2,8,8 ; [max 2]
- (iii) ions have opposite electrical charges ;
opposites attract / (which have a) strong attractive (force) / strong attraction ; [2]
- [Total: 12]**

- 5 (a) calcium ; [1]
- (b) water ; [1]
- (c) they contain protein ; [1]
- (d) orange / brown / yellow ;
it does not contain starch ; [2]
- (e) protein, fat and carbohydrate ; [1]
- (f) has more calcium ;
for, teeth / bones ;
OR
has more protein;
for making / cells / enzymes; [max 2]
- (g) calcium ;
can be absorbed as it is / it is already small enough to be absorbed ; [2]
- [Total: 10]**

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- 6 (a) (i) (gravitational) potential ;
kinetic ; [2]
- (ii) changed into sound/heat ; [1]
- (iii) worker Y (no mark)
same force but bigger distance/work is force \times distance and distance is bigger ; [1]
- (iv) joules ; [1]
- (v) (density =) mass \div volume ;
 $= 5000/5500 = 0.91 \text{ (g/cm}^3\text{)} ;$ [2]
- (b) (i) working and/or use of speed \times time ;
288(m) ; [2]
- (ii) 240(s) ; [1]
- (iii) boy C ;
(line on) graph goes down etc. (so speed was changing/decreasing) ; [2]
- [Total: 12]**

- 7 (a) (i) alloy ; [1]
- (ii) stronger/harder/better corrosion resistance ;
(assume refers to alloy) [1]
- (iii) vanadium oxide ;
(reduction is) removal of oxygen; (allow correct oilrig reference) [2]
- (iv) high density ;
(relatively) high melting point ;
can act as catalyst ;
forms coloured compounds ; [max 2]
- (b) (i) substance that changes/increases rate ;
but is not itself (permanently) changed ; [2]
(reject catalyst oxide does not take part in reaction)
- (ii) sulfur dioxide + oxygen \rightarrow sulfur trioxide ; [1]
- (iii) sulfur dioxide (or sulfur trioxide) is corrosive/harmful/irritant ;
reference to corrosion of fabric of factory ;
reference to specific damage to humans e.g. damage to respiratory system ; [max 2]
- [Total: 11]**

8 (a)

	producer	consumer	carnivore	herbivore
heron		√	√	
water snail		√		√
yellow water lily	√			

1 mark per correct row ;;;

[3]

(b) (i) eutrophication ;
increased growth of algae ;
reduction of (dissolved) oxygen ;
reference to toxins / named toxin ;

(ii) reference to greenhouse gas ;
traps heat ;
global warming ;
reference to consequence of global warming (e.g. sea level rise, more extremes of weather, change in habitats of living organisms) ;

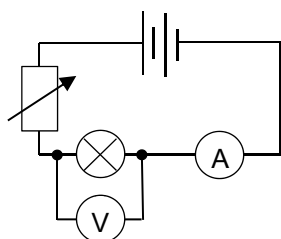
[max 2]

[Total: 7]

9 (a) current ;
current ;
potential difference ;

[3]

(b) (i) e.g.



at least 3 symbols correct ;
all 5 symbols correct ;
ammeter in series and voltmeter in parallel ;
everything else correct ;

[4]

(ii) $V = IR$;
 $R = 0.3 / 0.5 = 0.6 (\Omega)$;

[2]

(c) metals contract when cold ;
cables become too tight / damage pylons ;
if put up tight in summer ;

[max 2]

[Total: 11]

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10 (a) 4 ; [1]

(b) carbon dioxide ;
produces an acidic solution/lowers pH ; [2]

(c) (i) decrease ;
of 7 (°C) ; [2]
(–7 scores both)

(ii) endothermic ; [1]

(d) powder has large surface area ;
powder has higher rate of reaction (with acid) ;
which counteracts low rate caused by relatively low acid concentration ; [max 2]

[Total: 8]

11 (a) **A:** larynx ;
B: trachea ;
C: bronchiole ; [3]

(b) (i)

gas	percentage in inspired air	percentage in expired air
nitrogen	78	78
oxygen	21	17
carbon dioxide	0.04	4
noble gases	1	1

both required for 1 mark ; [1]

(ii) helium / neon / argon / krypton / xenon / radon ; [1]

(iii) respiration ;
uses oxygen and produces carbon dioxide ;
oxygen diffuses into blood (from lungs) and carbon dioxide diffuses from
blood (into lungs) ; [max 2]

(iv) limewater / hydrogencarbonate indicator ;
method bubbles both types of air through the indicator ;
reference to comparison of time taken for indicator to change colour ; [3]

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(c) (i) reference to energy/work ;
more energy used/more work done/per unit time ; [2]

(ii) increased ;
use of comparative figures (e.g. 0.5 dm^3 when no power output, 2.8 dm^3 at 225 W) ;
reference to change of gradient at 50 W ; [max 2]

(iii) faster/more breaths per minute ; [1]

[Total: 15]

12 (a) radiation ;
does not need a medium ; [2]

(b) refraction ; [1]

(c) same way up as object
same size as object
laterally inverted [max 2]
(3 correct 2 marks, 1 or 2 correct 1 mark) ;;

[Total: 5]