

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0653 COMBINED SCIENCE

0653/31

Paper 3 (Extended Theory), maximum raw mark 80

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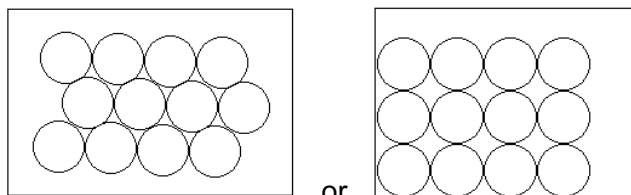
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hydrogen atoms labelled and no other electrons ; [2]
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formulae ; balanced ; [2]
- (iv) chemical (potential) to heat/thermal ; [1]
- (b) full outer electron shell ;
so, unreactive (with oxygen)/not flammable ; [2]
- 2 (a) (i) label line and letter **C** showing the nucleus ;
label line and letter **R** showing the cytoplasm ; [2]
- (ii) O_2 and H_2O in correct places ;
equation correctly balanced ; [2]
- (b) (i) $(830 + 670 =) 1500 \text{ kJ}$; [1]
- (ii) cycling and swimming ;
needs 1680 kJ/greater amount of energy needed ; [2]
- (iii) carry more oxygen/oxygen more quickly (to muscle cells) ;
carry more glucose/glucose more quickly (to muscle cells) ;
reference to respiration/energy release (in muscle cells) ;
carry more carbon dioxide/carbon dioxide more quickly (from muscle cells) ; [max 2]
- (iv) activities may be done at a faster/slower rate ;
avp ; [1]
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B to C: constant speed ; [2]
- (b) $\frac{1}{2} \times \text{base} \times \text{height} / \frac{1}{2} \times 10 \times 25$;
(squares counted allowed)
 $= 125(\text{m})$; [2]
- (c) (acceleration =) change in speed $\div$ time ;
 $= -25/10 = -2.5$ (accept 2.5) ;
 m/s^2 ; [3]

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(d)



or

(at least 12 circles in total with approximately uniform diameter)
 diagram must show a regular arrangement ;
 most circles touching ;

[2]

- 4 (a) (i) named indicator/pH meter ;
 correct colour change/pH value <7 ; [2]
- (ii) calcium chloride ;
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- (b) (i) rate increases ; [1]
- (ii) reference to particles moving (not vibrating) faster /gaining kinetic energy ;
 rate of collision/collision frequency increases ;
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(ii) harp ; [1]

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(c) $(\lambda =) v/f$;
 $(\lambda =) 330 \div 1000 = 0.33 \text{ (m)}$; [2]

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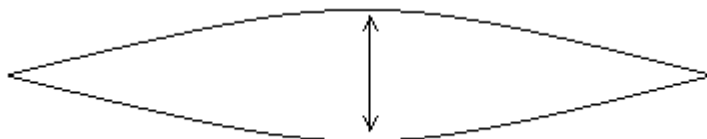


diagram illustrates a string vibrating after being plucked ;
vibrating string collides with air molecules / implication that sound / the wave
requires a medium to travel ;
producing compressions and rarefactions in air / longitudinal waves /
pressure waves ;

[3]

7 (a) (i) high temperature ;
catalyst ;
high pressure ; [max 2]

(ii) molecules of **X** and **Y** are smaller than molecules of **D** / ora ; [1]

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(b) two Cs in each ;
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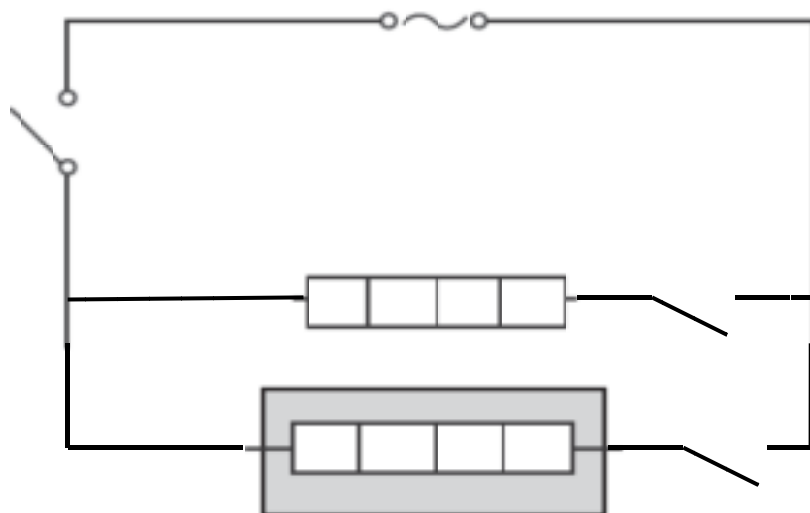
(ii) break down dead zebra / waste materials from zebra ;
 which releases chemicals ;
 example of recycled chemical substance ; [max 2]

9 (a) (i) convection ; [1]

(ii) warm air rises ;
 warm air is less dense ; [2]
 (ora)

(iii) description of thermal insulation / lagging ; [1]

(b)



switches in both heater branches (can be either side of heater) ;
 rest of circuit completed properly ; [2]

(c) (i) (p.d. =) current $\times$ resistance / $I \times R$;
 $= 30 \times 8 = 240$;
 V ; [3]

(ii) (power =) $4 \times 240 = 960$ (W) ; (allow e.c.f. from (c)(i)) [1]

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- 1 (a) 7 ;
number of outer electrons = Group number ; [2]
- (b) (i) cobalt chloride test paper / anhydrous cobalt chloride ;
turns (from blue to) pink ;
OR
anhydrous copper sulphate ;
turns (from white to) blue ; [2]
- (ii) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
formulae ;
balancing ;
states ; [3]
- (iii) 2 shared pairs ;
4 non-bonding electrons on O ; [2]
(max 1 if any other error)
- 2 (a) large surface area ;
for rapid / efficient diffusion / uptake / absorption of water / ions /
minerals / nutrients ; [2]
(allow a relevant named ion)
- (b) breaking down large / insoluble molecules ;
into small / soluble molecules ;
that can be absorbed ; [max 2]
- (c) (i) 40 °C ; [1]
- (ii) from 10 °C to 30 °C
speed (of digestion) was increasing ;
due to more frequent collisions (between molecules) ;
molecules have more kinetic energy ;

above 50 °C
speed (of digestion) was decreasing ;
due to denaturation of the enzyme ;
shape of enzyme / active site is changing ; [max 4]
(two marks to be awarded for each temperature)

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- 3 (a) (i) running at constant speed ; [1]
- (ii) reference to low (forward) speed/speed decreasing ; [1]
- (b) kinetic (energy) → gravitational (potential)/potential (energy) ;
potential (energy) → kinetic (energy) ; [2]
- (c) (falls to zero then) accelerating/going faster ; [1]
- (d) (distance =) $\frac{1}{2}$ base $\times$ height / $\frac{1}{2} \times 1 \times 4$; [2]
= 2 (m)
- (e) rise in temperature means particles vibrate more energetically/owtte ;
which increases (average) distance between particles/owtte ; [2]
- 4 (a) (i) **physical:** (iron oxide) settles/produced layers in rock/
iron compounds dissolved ;
chemical: compounds oxidised to iron oxide/
oxygen produced by bacteria ; [2]
- (ii) chemical change produces a new substance/ora ; [1]
(allow other correct differences)
- (b) (assume reference to ancient atmosphere if not specified)
difference: more carbon dioxide in ancient atmosphere ;
(allow other reasonable ideas based on the diagram
e.g. noble gases, polluting gases or water vapour)
similarity: nitrogen largest component ; [2]
- (c) (i) carbon monoxide ; [1]
- (ii) coke/coal and air/oxygen ; [1]
- (iii) copper forms weaker bonds with oxygen than does iron ;
copper is lower than iron in the reactivity series ; [2]
- (iv) (limestone/calcium carbonate decomposes to produce) calcium oxide ;
which reacts with silicon dioxide ;
to form molten slag/calcium silicate ;
which floats on/forms a separate layer on molten iron ; [max 2]

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- 5 (a) (i) pulmonary artery correctly labelled ;
vena cava correctly labelled ; [2]
- (ii) blockage/narrowing of coronary arteries ;
(due to) cholesterol/fat deposits/plaques ;
lack of oxygen supplied to heart muscle ; [max 2]
- (b) (i) number of deaths (per 100 000 population per year) increased
as the (average) number of cigarettes smoked increased ;
appropriate reference to figures ; [2]
- (ii) less stress ;
less fat in the diet ;
more exercise taken ;
inherited likelihood (of developing CHD) ;
more people die from other causes ;
improved / more effective treatment for CHD available ; [max 2]
- (c) cilia cannot (beat to) remove the mucus bacteria/pathogens ;
and then 1 from
bacteria/pathogens are trapped/contained in mucus OR
bacteria/pathogens stay in the lungs/breed in the mucus ; [max 2]
- 6 (a) (i) water goes up and down at right angles to direction of travel of wave / owtte [1]
- (ii) oscillating spring / sound waves / avp ; [1]
- (b) speed ; [1]
- (c) (i) frequency less than lower limit of hearing ; [1]
- (ii) $(v =) f\lambda$;
 $= 30 \times 1 = 30$;
unit: cm/s ; [3]
(unit must be consistent with working)
- (iii) by vibrations (of air) ;
from particle to particle / through particles / by collision between particles ;
(in the form of) compressions and rarefactions / as longitudinal waves ; [max 2]

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- 7 (a) (i) ethane ;
C₂H₆ ; [2]
- (ii) fraction with higher boiling point (range) contains larger molecules ;
larger molecules have greater intermolecular forces ;
more energy required to overcome larger intermolecular forces ; [3]
- (b) chloride / Cl⁻ ions move to anode/positive electrode ;
opposite charges attract ;
electrons pass from chloride/Cl⁻ ions to anode/positive electrode /
correct electrode equation ; [max 2]
(allow chloride ions are oxidised)
- 8 (a) (i) particles reduce amount of light (landing on the leaf) ; [1]
- (ii) carbon dioxide prevented from entering leaf ; [1]
- (b) (i) less photosynthesis to produce oxygen ;
reference to respiration by animals or decomposers using up oxygen ;
the combustion of wood ; [max 2]
- (ii) less oxygen available for respiration ; [1]
- (c) global warming / increased greenhouse effect /
consequence of global warming described e.g. rising sea level /
climate change / examples of extreme weather events ; [1]
- (d) water (vapour) / sulfur dioxide / nitrogen oxide(s) / carbon monoxide / soot ; [1]

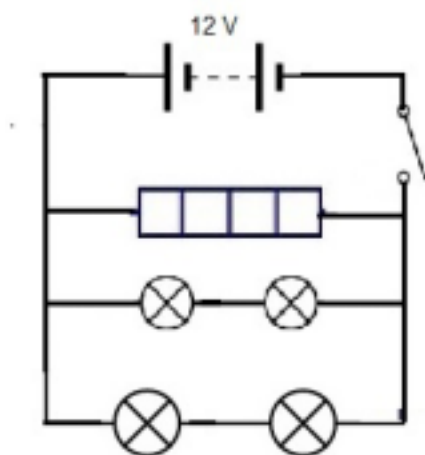
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- 9 (a) two points from
potential difference / volts / voltage ;
required to drive the current ;
6 (volts) required to allow lamp to work properly / safely ;

two points from
power / watts / wattage ;
energy / second transferred ;
120 (watts) is the safe maximum / owtte ;

[max 4]

(b)



sidelamps remain in series with each other and each pair in parallel
with the battery ;
heater, sidelamps, headlamps all in parallel ;

[2]

- (c) $(I =) P / V$ or equivalent ;
 $(I =) 120 / 12 = 10 \text{ (A)}$;

[2]

- (d) convection ;

[1]

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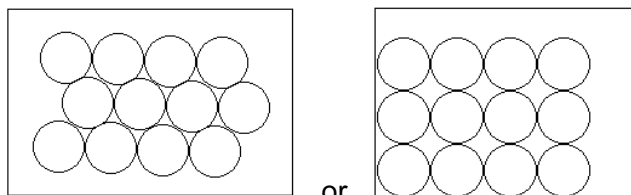
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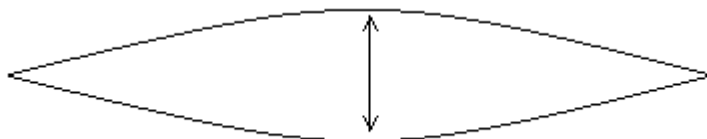


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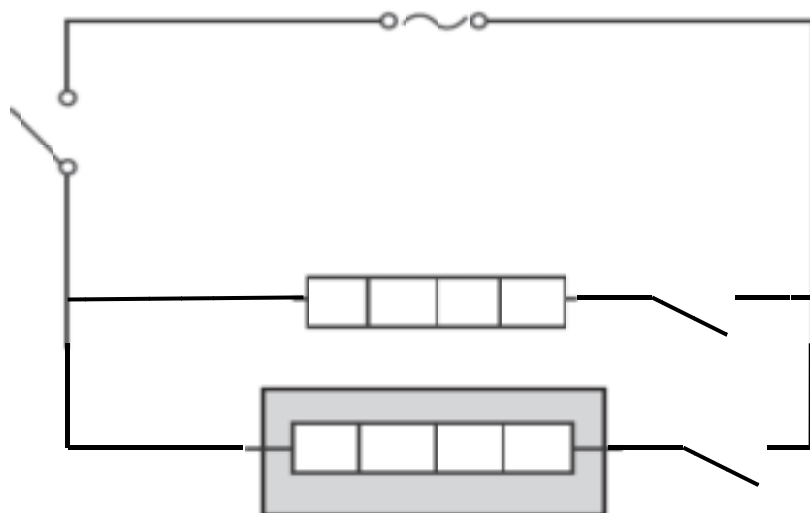
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