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COMBINED SCIENCE

0653/33

Paper 3 Extended Theory

May/June 2016

MARK SCHEME

Maximum Mark: 80

Published

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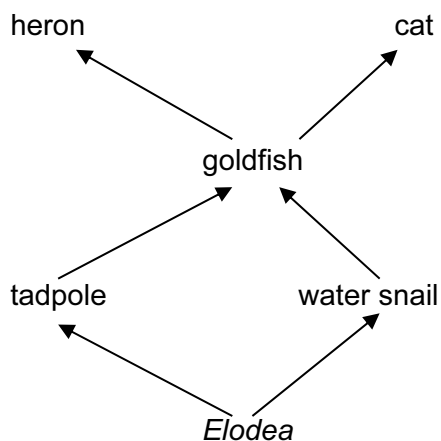
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- 1 (a) (i) contains two (or more) different atoms/substances/elements/compounds ;
NOT chemically joined together / NOT chemically combined ; [2]
- (ii) **A C D** ;
spots from **Y** match spots in **A, C** and **D**/owtte ; [2]
- (b) O-H bond / –OH shown ;
rest of molecule correct ; [2]
- (c) (i) ethene + water/steam → ethanol ; [1]
- (ii) double bond shown ;
rest of molecule correct ; [2]
- (iii) bromine (solution) ;
(ethane) no reaction /owtte ;
(ethene) decolourises bromine ; [3]
- 2 (a) 10 (V) ; [1]
- (b) (i) $(R =) V / I$;
 $= 2 / 0.4 = 5$;
 Ω ; [3]
- (ii) $(P =) VI$;
 $= 12 \times 0.4 = 4.8$ (W) ; [2]
- (iii) resistance of **Y** is greater than resistance of **X** /
pd across **Y** is greater than pd across **X** ; [1]
- (c) all lights get full mains voltage / shone at max brightness ;
each light can be switched on / off independently ;
if one light fails, the others will still work ; [max 2]
- 3 (a) as the light intensity increases the rate of photosynthesis increases ;
further detail using numbers extracted from the graph e.g. increase in rate
declines at 0.06 ; [2]
- (b) (i) similar shaped line drawn below the existing one ; [1]
- (ii) fewer bubbles per minute / amount of photosynthesis has decreased ;
less chlorophyll / fewer chloroplasts present / fewer leaves / fewer stomata
present to release oxygen ; [2]
- (c) (i) tadpole, goldfish, heron ; [1]

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(ii) goldfish does not eat/digest/absorb all of the tadpole ;
energy lost due to respiration/other life process/heat energy lost ; [2]

(d) food web correctly drawn with *Elodea* and goldfish only written once ;
arrows in correct direction ;
e.g.



[2]

4 (a) 2, 8, 1 [1]

(b) (i) $2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + \text{H}_2\text{(g)}$; [2]

(ii) rubidium melts ;
flame ;
gas given off ;
temperature increase ; [max 2]

(iii) chemical (potential energy) \rightarrow thermal or heat/light/kinetic (energy) [1]

(c) reference to filled outer shell in Group VIII elements ;
Group I has 1 electron in outer shell that can be lost ; [max 2]

(d) (i) CO_2 absorbs heat radiated from Earth's surface/prevents heat escaping into space ; [1]

(ii) extremes of weather/flooding caused by excessive rain or rising sea levels/drought/fires/increasing storm damage to humans or habitats ; [1]

5 (a) (gravitational) potential ; [1]

(b) (speed =) distance/time ;
 $= 2 \times 990/6 = 330 \text{ (m/s)}$; [2]

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- (c) (i) vibrations in different directions ;
longitudinal vibrations move in same direction as wave/energy moves ;
transverse vibrations move at right angles to direction that wave/energy moves ;
longitudinal waves need a medium to travel through ; [max 1]
- (ii) 20 Hz (allow 10 Hz) and 20 000 Hz (allow 25 000 Hz) ; [1]
- (d) (i) temperature at which a solid changes state and becomes a liquid ; [1]
- (ii) particles are randomly arranged ;
most particles are touching ; [2]
- (e) 3×10^{-8} m/s (no mark)
all electromagnetic waves travel at the same speed (in vacuo) ; [1]
- 6 (a) (artery)
thick wall ;
prevents bursting ;
OR
contains elastic tissues ;
for recoil/smoothing flow of blood ;
AND
(vein)
contain valves to prevent backflow of blood ; [3]
- (b) towards ;
deoxygenated ;
oxygenated ;
pulmonary vein ;
away from ; [5]
- 7 (a) chlorine (gas) ; [1]
- (b) (i) at least two different sizes of atom ;
one of the atoms in the majority and generally in a regular arrangement ; [2]
- (ii) the layers of metal atoms cannot easily slide over each other/owtte ; [1]
- 8 (a) (i) acceleration = change in speed/time or $(-)/8/40$;
= $(-)/0.2$ (m/s²) ; [2]
- (b) (calculate the) area under the graph ;
further detail such as how to calculate area of rectangle and triangle/add separate areas together ;
 $(8 \times 60) + (\frac{1}{2} \times 8 \times 40)$;; [max 2]

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- (c) R and Q ; [1]
- (d) (i) first reflection at correct angle (by inspection) ;
ray passes down fibres and emerges at the other end ; [2]
- (e) (i) endoscope/key hole surgery ; [1]
- (ii) surgery not needed or minimal trauma/other correct ; [1]
- 9 (a) $C_6H_{12}O_6$ and $6H_2O$; [1]
- (b) (i) (mucus)
traps pathogens/dust/other valid named substance ;
(cilia)
beat upward to remove mucus from airway ; [2]
- (ii) cilia become paralysed/move more slowly ;
by tar/heat ;
so mucus/pathogens/dust not removed from the trachea ; [max 2]
- (c) collects/picks up oxygen from mother's blood (in uterus) ;
by diffusion ; [2]
- (d) (i) amniotic (fluid) ; [1]
- (ii) fetus could be physically damaged/infection/other correct ; [1]