Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

COMBINED SCIENCE **0653/33**

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

MARK SCHEME

Maximum Mark: 80

Published

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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 × 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]

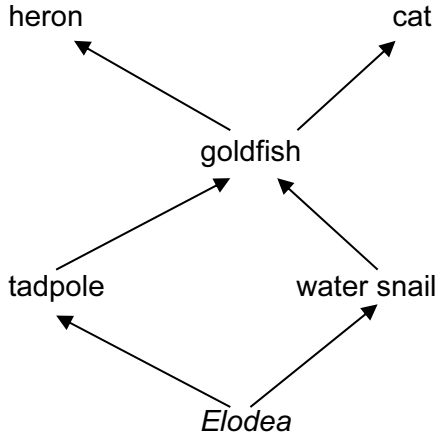
(b) **(i)** similar shaped line drawn below the existing one ; [1]

(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]

(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**Na(s) + **2**H_2O(l) → **2**NaOH(**aq**) + H_2(**g**) ; [2]

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

(iii) chemical (potential energy) → 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 × 990 / 6 = 330 (m / s) ; [2]

(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 / s^2) ; [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]

(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]