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**COMBINED SCIENCE**

**0653/33**

Paper 3 Extended Theory

**October/November 2016**

MARK SCHEME

Maximum Mark: 80

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**Published**

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- 1 (a) (i) work done = force  $\times$  distance /  $F \times d / 300 \times 0.4$  ;  
= 120 ;  
J ; [3]
- (ii) 120 (J) ;  
*allow ecf from (i)* [1]
- (b) (i)  $KE = \frac{1}{2} mv^2 / \frac{1}{2} \times 0.1 \times (30)^2$  ;  
= 45 (J) ; [2]
- (ii) efficiency = energy out / energy in  $\times 100$  (*or equivalent*) ;  
=  $(45 / 120) \times 100 = 37.5$  (%) ; [2]
- (iii) (slowed down by) air resistance / friction / other reasonable opposing force ; [1]
- 2 (a) (i) stopwatch / timer ; [1]
- (ii) calcium / Ca ; [1]
- (b) *concentration*  
higher concentration increases speed / less time for the reaction ;  
higher number of particles / particles are closer together ;  
(so) particles collide more often ;  
*temperature*  
Higher temp increases speed / less time for the reaction ;  
particles have more energy / are moving faster ;  
(so) particles collide more often / particles collide with more energy /  
more successful collisions ; [max 4]
- (c) calcium  
magnesium  
zinc  
iron  
copper ;  
all 5 correct [1]
- (d) (test-tube **A**) tin is less reactive than magnesium ;  
(test-tube **B**) lead is more reactive than copper ; [2]

- 3 (a) (i) blood passes through the heart twice for each circuit/there are two circulation paths – one to the lungs and one to the body ; [1]
- (ii) **C** and the aorta ;  
takes blood from left ventricle /chamber with the thickest wall / blood has to go greater distance / owtte ; [2]
- (iii) (valves)  
prevent backflow of blood ;  
(wide lumen)  
reduces resistance of blood flow ; [2]
- (b) (i) to supply more oxygen / glucose (to the cells / muscles) ;  
for respiration ;  
to release / supply more energy (for contraction of muscles) ;  
to remove carbon dioxide more quickly ; [max 3]
- (ii) any suitable activity, e.g. walking **and**  
activity is more energetic / active / uses more oxygen than sitting but is less energetic / active / uses less oxygen than running ; [1]
- 4 (a) (i)
- |                 |  |              |  |           |  |             |  |
|-----------------|--|--------------|--|-----------|--|-------------|--|
| Gamma radiation |  | ultra-violet |  | infra-red |  | radio waves |  |
|-----------------|--|--------------|--|-----------|--|-------------|--|
- infra-red ;  
in correct box ; [2]
- (ii) All e/m waves travel at same (high) speed (*in vacuo*) ; [1]
- (b) (i) (matt) black ; *accept* reasonable alternatives that have a deep hue, e.g. deep (or dark) blue  
black is a better absorber of i/r ; [2]
- (ii) conduction ;  
convection ; [2]
- (iii) water expands on heating ;  
heated / hot / warm water less dense than cold, (so rises while cold sinks)  
; owtte [2]

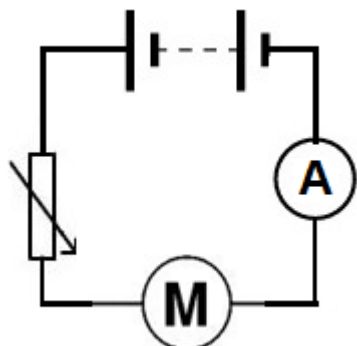
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- 5 (a) (i) methane ; [1]
- (ii) fossil / non-renewable ;  
fractional distillation ; [2]
- (b)  $C_8H_{18}$  ;  
 $C_2H_4$  ; [2]
- (c) (i) contains carbon & hydrogen ;  
*and one of*  
a compound / molecule ;  
only ; [2]
- (ii)  $C_6H_{12}$  because (general formula is)  $C_nH_{2n}$  / unsaturated / contains a  
double bond ; [1]
- (iii) bromine / bromine water ;  
(alkanes) no change  
and  
(alkenes) decolourised ; [2]
- 6 (a) (stamen)  
longer / found dangling outside the flower ;  
(stigma)  
feathery / larger / found outside the flower ; [2]
- (b) slide 1 – no mark  
smaller / lighter therefore can be carried by the wind ;  
smoother surface therefore less friction / air resistance ; [max 1]
- (c) (i) any two from  
increased rate of transpiration (at 27 °C) / more water lost from plant ;  
molecules have more (kinetic) energy ; [2]
- (ii) any value less than 1.1 cm because the rate of evaporation / transpiration is  
lower in humid conditions ; [1]
- (d) root X – no mark  
it has root hair cells ;  
larger surface area for absorption of water ; [2]
- (e) traps light energy ;  
converts it to chemical energy / glucose ; [2]

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- 7 (a) (i) 50 (cm) ; [1]
- (ii) maximum displacement (from no displacement to peak) ; [1]

(b)

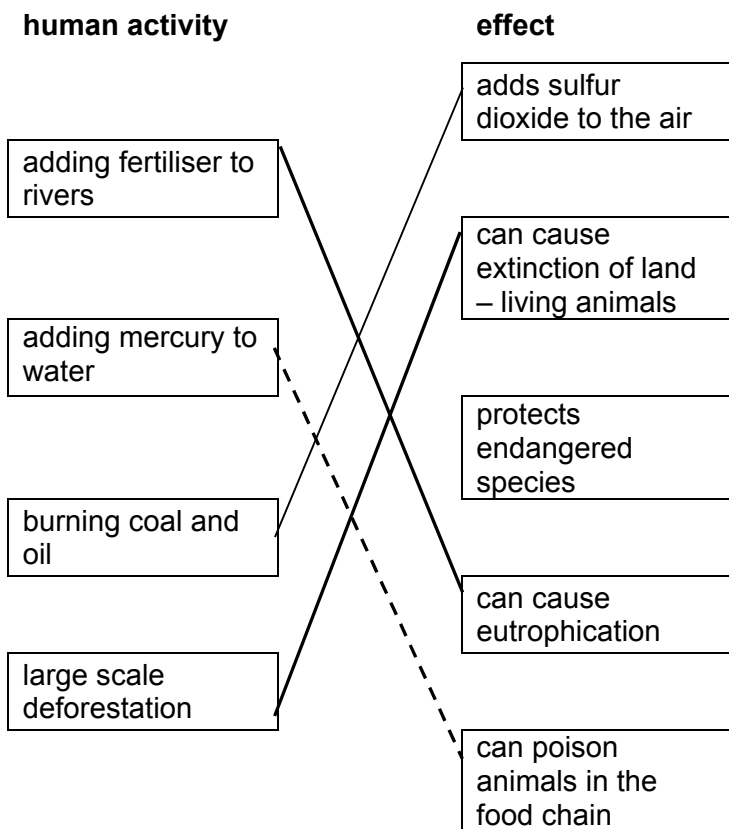


variable resistor symbol ; [3]  
 ammeter symbol ;  
 all connected in series to form a complete circuit ;

- (c) (i)  $R = V \div I / 3 \div 2$  ; [2]  
 $= 1.5 (\Omega)$  ;
- (ii) power =  $V \times I / 3 \times 2$  ; [2]  
 $= 6 \text{ watt(s) / W}$  ;

- 8 (a) solid at room temp/below melting point ; [2]  
 ions must be mobile ;
- (b) ions move towards the anode / positive electrode ; [2]  
 ions lose (two) electrons / (two) electrons move to the anode / ions are discharged / become atoms ;
- (c) reduced because it loses oxygen ; [1]  
 accept aluminium (ions) gain electrons
- (d) 2 electrons in 1st shell and 8 in 2nd shell ; [1]
- (e) ionic ; [2]  
 metal and non-metal combined ;

9 (a)



[3]

(b) (i) burning fossil fuels / deforestation ;

[1]

(ii) (explanation of greenhouse gas) absorbs heat / infra-red radiation from the earth ;  
 causes the temperature of the atmosphere to rise / global warming carbon dioxide is a greenhouse gas ;  
 consequence, e.g. flooding / melting ice caps / changes in weather patterns / avp ;

[3]