



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES

0654/31

Paper 3 Extended Theory

May/June 2016

MARK SCHEME

Maximum Mark: 120

Published

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1 (a) white surfaces are better reflectors of thermal energy /
white surfaces are poorer absorbers of thermal energy ; [1]

(b) kinetic to electrical ; [1]

(c) (i) efficiency = energy out/energy in or
energy used = $15/100 \times 400\,000$;
= 60 000 (J) ; [2]

(ii) (temperature rise =) energy/mass \times shc or
 $60\,000/(4 \times 4200)$;
3.6 ($^{\circ}\text{C}$) ; [2]

(d) tidal, wave, geothermal, HEP, (named) biomass: any two ;; [2]

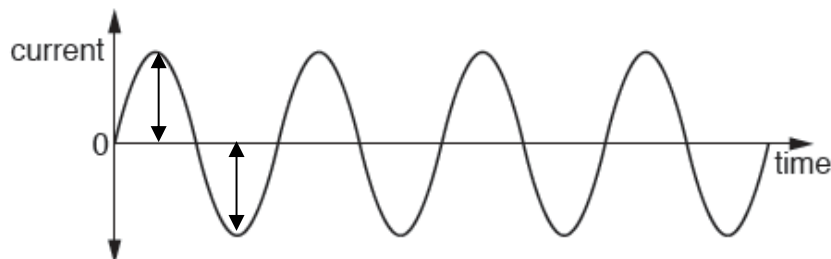
(e) (i) in space of left of infra-red ;

	X rays		<i>visible light</i>	infra-red		radio waves
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[1]

(ii) $300\,000\,000/3 \times 10^8$ (m/s) ; [1]

(f) amplitude correctly indicated ;
either :



[1]

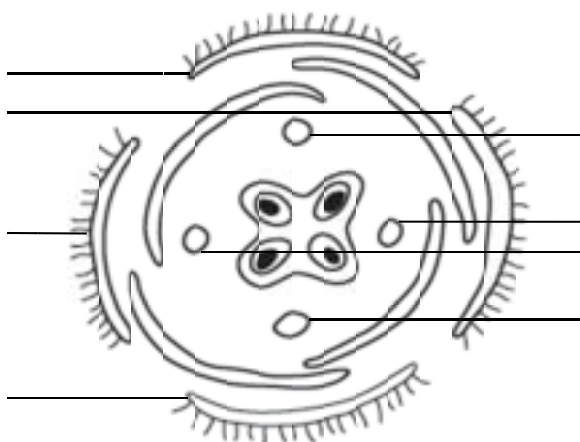
[Total: 11]

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- 2 (a) (i) sepal correctly labelled ;
stamen correctly labelled ;

any sepal

any stamen



[2]

- (ii) unable to pollinate (other flowers) ;

[1]

- (iii) stigma / stamens inside petals ;
has petals ;
flat / lobed stigma ;

[max 2]

- (b) (i) 33–34 ;

[1]

- (ii) 35–100.0 (metres) ;

[1]

- (iii) range is greater than the others / AW ;

[1]

- (iv) colonises new areas ;
prevents overcrowding / competition within the species ;

[2]

- (v) animals / edible fruits / carried on fur ;

[1]

- (vi) both dispersed further ;
because longer in the air subject to influence of wind /
force is greater ;

[2]

- (c) plumule labelled ;
radicle labelled ;
plumule touching radicle ;
cotyledon labelled ;

[4]

[Total: 17]

- 3 (a) (i) filtration / passed through a filter ;

[1]

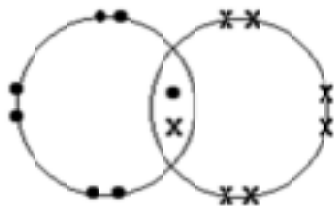
- (ii) reference to risk of (named) disease ;

[1]

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- (b) (i) electrolysis ; [1]
- (ii) hydrogen ; [1]
- (iii) (damp) litmus / (Universal) indicator paper ;
bleached / changes colour to white ; [2]
- (iv) 7 to value > 7 up to a maximum of 14 ;
solution becomes alkaline / sodium hydroxide is produced ; [2]

(v)



- one shared pair ;
all lone pairs and no extra electrons ; [2]

[Total: 10]

- 4 (a) (i) (acceleration =) change in speed / time or
(acceleration =) $15 / 10$;
 $= 15 \text{ (m/s}^2\text{)}$; [2]
- (ii) (force =) mass \times acceleration or
(force) = 2000×1.5 ;
 $= 3000$;
N ; [3]
- (iii) area under graph or evidence on graph or
 $\frac{1}{2} \times 20 \times 10$;
100 (m) ; [2]

- (b) (i) charge ;
friction ;
electron transfer ;
(complete circuit) to / from earth ; [max 2]
- (ii) (charge =) current \times time or
 $= 0.004 \times 0.0001$;
 $= 0.0000004 / 4 \times 10^{-7} \text{ (C)}$; [2]

[Total: 11]

- 5 (a) X = (plant) respiration ;
Y = decomposition / decay / respiration ; [2]

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(b) (i) CO₂ used for photosynthesis ;
less CO₂ absorbed / less photosynthesis ;
CO₂ produced by burning timber / CO₂ produced by decomposition / AW [3]

(ii) because combustion produced CO₂ ; [1]

[Total: 6]

6 (a) (i) number of protons in the nucleus/one atom ; [1]

(ii) proton positive(ly charged) and electron negative(ly charged) ;
proton has greater mass ; [2]

(b) (i) caesium 1 and iodine 7 ; [1]

(ii) CsI ;
ionic ; [2]

(iii) caesium atom loses one / its outer electron ;
iodine atom gains one electron ; [2]

(c) (i) the higher the temperature the greater mass of solid dissolves ; [1]

(ii) 130 (g) [1]

(iii) calculation of M_r [CsI]
133 + 127 / 260 ;
change volume units from 100 cm³ to dm³
mass dissolving in 1 dm³ = 1300 g ;
calculation of concentration in moles / dm³
1300 ÷ 260 = 5 (mol / dm³) ;
OR
calculation of M_r [CsI]
133 + 127 / 260 ;
calculation of concentration in mol / 100 cm³
130 / 260 = 0.5 mol / 100 cm³ ;
change volume units from 100 cm³ to dm³
concentration = 5 mol / dm³ ; [3]

[Total: 13]

7 (a) plastic / glass
iron
glass / plastic
copper
4 correct = 2 marks, 3 or 2 correct = 1 mark ; [2]

(b) (i) 54 ; [1]

(ii) ⁵⁶/₂₆Fe [1]

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(iii) time taken for a sample of radioactive isotope to decay by half/
time taken for count rate of radioactive isotope to decrease by half ; [1]

(c) evaporation can occur at any temperature/
boiling only happens at the boiling point ;

evaporation happens only at the surface/
boiling happens throughout the liquid ;

evaporation lets only the molecules with the highest kinetic energy out/
boiling taken energy in (endothermic) to occur ;

evaporation can occur using the internal energy of the system/
boiling requires an external source of heat ;

evaporation produces cooling/
boiling does not produce cooling ;

evaporation is a slow process/
boiling is a rapid process ;

[max 1]

(d) reference to induced magnetism ;

[1]

(e) **A** (no mark)

regular arrangement ;

[1]

(f) workable method of measurement of displacement ;
ref to displacement/ subtraction of two volumes ;

[2]

[Total: 10]

8 (a) obesity ;
blocking coronary arteries ;
(leading to) (coronary) heart disease ;

[3]

(b) (i) liver labelled on Fig. 1.1 ;

[1]

(ii) emulsifies ;
increases surface area for, enzyme action / faster digestion ;

[2]

(iii) large surface area ;
thin wall ;
lacteals ;

[max 2]

[Total: 8]

9 (a) (i) transition (metals / series / elements) ;

[1]

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- (ii) elements or their compounds can behave as catalysts ;
compounds have colours other than white ; [2]
- (iii) iron atoms ;
reference to electrons being lost ; [2]
- (iv) this alloy does not rust ; [1]
- b** (i) blast furnace ; [1]
- (ii) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
formulae ;
balancing ; [2]
- [Total: 9]**
- 10** (a) (i) ray of light correctly drawn from Y to X ; [1]
- (ii) normal correctly drawn ; [1]
- (iii) angle of incidence correctly labelled ; [1]
- (iv) same size as object, upright, virtual ; [1]
- (b) compression: particles close together/rarefaction: further apart
OR
compression: region of high pressure/rarefaction: region of low pressure ; [1]
- (c) (i) ammeter and voltmeter ; [1]
- (ii) $1/R_T = 1/R_1 + 1/R_2$ or $1/R_T = 1/12 + 1/4 = 1/3$ or
 $R_T = R_1R_2/(R_1 + R_2)$ or $R_T = 48/16$;
 $R_T = 3 (\Omega)$; [2]
- [Total: 8]**
- 11** (a) (i) **FF** and Ff ; [1]
- (ii) have ff genotype ; [1]
- (b) (i) camouflage / AW ; [1]
- (ii) less well adapted / less likely to survive / more likely to be preyed on ;
(so) less likely to reproduce ; [2]

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- (c) (correct gametes) H, h, H, h ;
 (correct genotypes) HH, Hh, Hh, hh ;
 (correct phenotypes) short fur, short fur, short fur, long fur ;
 (correct ratio) 3 short : 1 long ; [4]

[Total: 9]

12 (a) (i) L diamond and M graphite ; [1]

(ii) contains only one type of atom ; [1]

(iii) (M)
 reference to the layer structure ;
 reference to (layers) sliding ;
 reference to weak (attractive) forces (between layers) ; [max 2]

(b) (i) (reactants)
 energy is transferred from reactants ;
 as thermal energy / reaction is exothermic ; [2]

(ii) powder has a large surface area ;
 the idea that the probability / frequency of collision (between oxygen molecules and the solid surface / carbon atoms) is higher ; [2]

[Total: 8]