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 × 400 000 ; = 60 000 (J) ; [2]

(ii) (temperature rise =) energy / mass × shc or 60 000 / (4 × 4200) ; 3.6 (°C) ; [2]

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

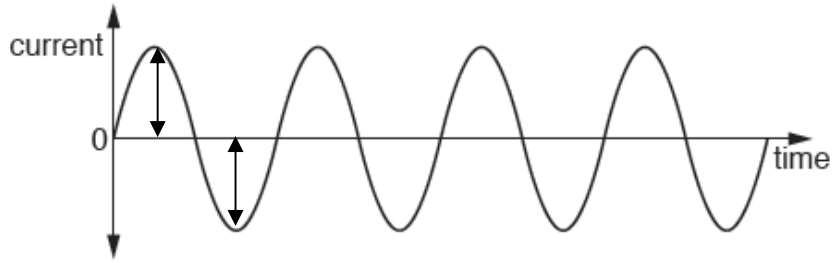
(e) **(i)** in space of left of infra-red ;

	X rays		*visible light*	infra-red		radio waves

[1]

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

(f) amplitude correctly indicated ;
either :

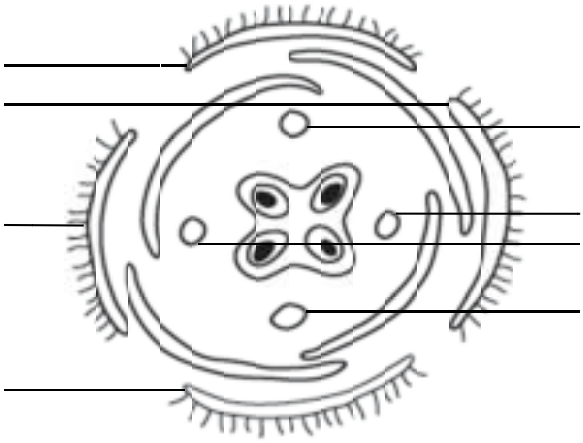


[1]

[Total: 11]

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]

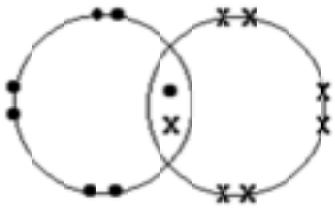
(b) (i) electrolysis ; [1]

(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 (m/s^2) ; [2]

(ii) (force =) mass × 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 × time or
= 0.004 × 0.0001 ;
= 0.0000004 / 4×10^{-7} (C) ; [2]

[Total: 11]

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

(b) (i) CO_2 used for photosynthesis ;
less CO_2 absorbed / less photosynthesis ;
CO_2 produced by burning timber / CO_2 produced by decomposition / AW [3]

(ii) because combustion produced CO_2 ; [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 cm^3 to dm^3
mass dissolving in 1 dm^3 = 1300 g ;
calculation of concentration in moles / dm^3
1300 ÷ 260 = 5 (mol / dm^3) ;
OR
calculation of M_r [CsI]
133 + 127 / 260 ;
calculation of concentrarion in mol / 100 cm^3
130 / 260 = 0.5 mol / 100 cm^3 ;
change volume units from 100 cm^3 to dm^3
concentration = 5 mol / dm^3 ; [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) $^{56}_{26}Fe$ [1]

(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]

(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) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
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]

(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 <u>from reactants</u> ;
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]