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 × 10^8 (m / s) ; [1]

(f) amplitude correctly indicated ;
either :
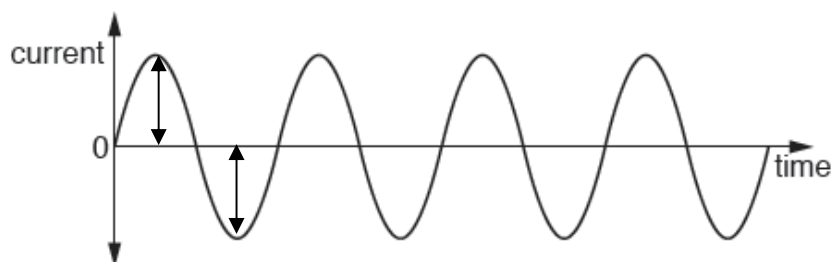
[1]

[Total: 11]

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

any sepal   any stamen
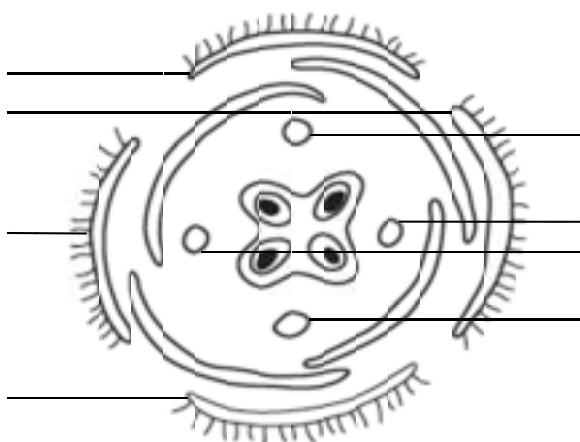
[2]

(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]

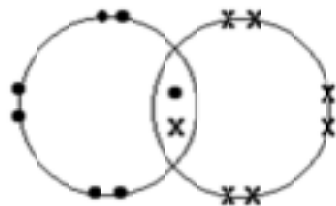**3 (a) (i)** filtration / passed through a filter ;   [1]

(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 $\times$ acceleration or
(force) = 2000 $\times$ 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 ;
<u>friction</u> ;
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} (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 <u>in the nucleus / one atom</u> ; [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]

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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]

  (ii) elements or their compounds can behave as catalysts ;
    <u>compounds</u> have colours other than white ;   [2]

  (iii) iron atoms ;
    reference to electrons being lost ;   [2]

  (iv) this <u>alloy</u> 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** <u>and</u> 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]