

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0654 CO-ORDINATED SCIENCES

0654/32

Paper 3 (Extended Theory), maximum raw mark 120

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- 1 (a) (i) (named) decomposer ; [1]
- (ii) nitrate ;
phosphate ;
potassium ;
magnesium ;
other named essential mineral ion ; [max 2]
- (b) (i) carbon dioxide ;
ethanol ; [max 2]
- (ii) keep the compost bin warm ;
mix/aerate the compost ;
break up compost into smaller pieces ; [max 2]
- (c) dead matter recycled/(nutrients in) crop not being removed ; [1]
- [Total: 8]**
- 2 (a) (i) magnesium
zinc
J
hydrogen
copper ;; [2]
- (ii) copper ions ;
brown deposit made of copper atoms ;
copper ions gain electrons ;
gain of electrons is reduction ; [max 3]
- (b) (i) regular arrangement of gold atoms ;
interspersed with fewer of the different atom ; [2]
- (ii) mass of diamond in grams = $186 \times 0.2 = 37.2 \text{ g}$;
moles C = $\frac{37.2}{12} = \underline{3.1}$ (moles) ; [2]
- [Total: 9]**
- 3 (a) (i) distance = area under graph (or working on graph) ;
= $25 \times 100 + \frac{1}{2} \times 150 \times 25 = 4375$;
m ; [3]
- (ii) (KE =) $\frac{1}{2} mv^2$;
= $\frac{1}{2} \times 500\,000 \times 20 \times 20 = 100\,000\,000 \text{ (J)} = 100\,000 \text{ (kJ)}$; [2]

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- (b) (i) density decreases ;
mass does not change ;
kinetic energy of particles increases / speed of particles increases ;
particles move further apart ; [max 3]
- (ii) volume = 125 000 cm³ ;
mass = 7.8 × 125 000 = 975 000 g ;
= 975 (kg) ; [3]

[Total: 11]

- 4 (a) petroleum / crude oil ; [1]

- (b) reference to fractions having different boiling ranges / points ;
reference to smaller molecules in materials with lower boiling points ;
reference to the temperature gradient in the tower ;
reference to collection of fraction at heights corresponding to boiling point ; [max 3]

- (c) (i) cracking ; [1]

- (ii) (react with) bromine (solution / liquid) ;
decolourised if hydrocarbon is unsaturated ; [2]

- (iii) the idea of applying the test before and after the cracking ;
the result that decolourisation only occurs following the cracking process ; [2]

[Total: 9]

- 5 (a) taking in nutrients / organic substances / mineral ions ;
containing raw materials / energy ;
absorbing / assimilating them ; [max 2]

- (b) (i) unbalanced diet / wrong amount of some part of the diet ; [1]

- (ii) too much energy / too much fatty food / too much carbohydrate / sugar so
(human) body (makes /) stores as fat ; [1]

- (c) (i) increases ;
after 1970 / no increase before 1970 ;
from 5% to 21–22% / by 16–17% ; [max 2]

- (ii) more available / fast food ;
people take less exercise ; [max 1]

- (iii) diabetes ;
arthritis ;
(coronary) heart disease ;
high blood pressure / cholesterol ;
reduced fertility ;
cancer ; [max 2]

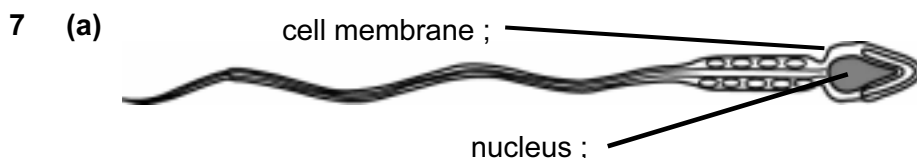
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- (d) (i) making/maintaining bones ;
absorbing/using calcium ; [max 1]
- (ii) egg /liver/ (oily) fish /milk /other milk products ; [1]
- (iii) rickets ;
soft /brittle bones /'bending' of legs ; [2]

[Total: 13]

- 6 (a) mirror drawn at suitable angle ; [1]
- (b) total internal reflection /angle of incidence greater than critical angle; [1]
- (c) steel will be attracted to magnet /aluminium alloy will not be attracted; [1]
- (d) (i) $P_1V_1 = P_2V_2$;
 $V_1 = \frac{P_2V_2}{P_1} = 2 \times 10^5 \times \frac{1600}{1} \times 10^5 (= 3200 \text{ cm}^3)$; [2]
- (ii) number of strokes = $\frac{3200}{90} = 35.55$ so 36 ; [1]

[Total: 6]



[2]

- (b) male gametes smaller /ORA ;
male gametes produced in larger numbers /ORA ;
male gametes elongated shape /ORA ; [max 3]
- (c) (i) 20 °C ; [1]
- (ii) lower rate of respiration /enzymes less active /less kinetic energy for enzymes ; [1]
- (iii) any suggestion below 62.5% ; [1]

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- (d) (i) less mobile, because too warm ; [1]
- (ii) sperms are more mobile as they are outside the body cavity and therefore cooler/owtte ; [1]
- (iii) reduced, because sperm mobility reduced ; [1]

[Total: 10]

- 8 (a) (i) radiation ; [1]
- (ii) car **A**/black car – black surfaces absorb heat more ; [1]

(b) (i) $(R) = \frac{V}{I}$;
 $= \frac{12}{4.8} = (2.5(\Omega))$; [2]

(ii) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$;
 resistance (R_T) = 1.25 (Ω) ; [2]

- (c) (i) 20(Hz) to 20 000 (Hz) ;
(both needed for mark) [1]

(ii) (distance =) speed \times time ;
 $= 34\,000 \times \frac{0.002}{2} = 34(\text{cm})$; [2]

(iii) $v = f \times \lambda$;
 wavelength = $\frac{340}{40\,000} = 0.0085(\text{m})$; [2]

- (iv) compressions further apart ;
 larger wavelength ; [2]

[Total: 13]

- 9 (a) (i) 2,5 ; [1]
- (ii) reference to completion of outer shell ;
 so now 3 more electrons than protons/ion has 3 more negative electrons compared to the neutral atom ; [2]
- (iii) Mg_3N_2 ;
 reference to charge balance ; [2]

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(b) (i) $N_2 + 3H_2 \rightarrow 2NH_3$; [1]

(ii) use of damp, red litmus paper / universal indicator paper ;
 colour change to blue / purple ;
OR
 use of hydrogen chloride gas ;
 white smoke / ammonium chloride ; [max 2]

(iii) increases the surface area (of the catalyst) ;
 increases the frequency that gas molecules collide with the catalyst ; [2]

[Total: 10]

10 (a) (i) (efficiency =) $\frac{\text{useful energy (power) out}}{\text{useful energy (power) in}}$;
 $= \frac{800}{2400} = 0.33 \times 100 = 33(\%)$; [2]

(ii) nuclear fusion / nuclei join together (to release energy) ; [1]

(b) (i) γ -radiation ; [1]

(ii) (γ -radiation / gamma – *no mark if no explanation given*)
 not charged particles so not affected by electric field ; [1]

(c) (i) to reduce energy / power losses ;
 high voltage means low current ; [2]

(ii) number of primary coils less than number of secondary ;
 reference to a.c. / alternating current ;
 changing magnetic field induces secondary voltage ;
 reference to changing current leading to change in magnetic field ; [max 3]

[Total: 10]

11 (a) (i) folded / large surface area ;
 thin / permeable ;
 moist ; [max 2]

(ii) has blood vessels / (blood) capillaries ; [1]

(b) (i) carbon dioxide ; [1]

(ii) diffusion ; [1]

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(c) (i) slower gas exchange / oxygen uptake ;
(because) less surface area ; [2]

(ii) cancer ;
bronchitis ;
asthma ;
coughing / excess mucus ;
increased risk of colds / sore throat / etc. ;
AVP ; (**do not accept** references to CHD etc.) [max 2]

[Total: 9]

12 (a) (i) (*element: K or H*)
cannot be simplified / contains atoms with same proton number / contains only one type of atom ;
(*compound potassium hydroxide or water*)
made of different types of atom bonded together / can be simplified / broken into elements ; [2]

(ii) same numbers of each type of atom on both sides ; [1]

(iii) *state symbol*: (l) refers to a (single) liquid substance / (liquid containing only one type of molecule) ;
state symbol: (aq) refers to a solution of a substance in water ; [2]

(iv) green to purple / blue ;
potassium hydroxide is an alkali / solution becomes alkaline / pH increases ; [2]

(v) reaction is exothermic / heat given off ;
hydrogen gas ignites ; [2]

(b) (i) line clearly drawn to any shared pair and labelled with an **S** ; [1]

(ii) each atom becomes stable if it can gain complete valence shell / owtte ;
complete shells achieved by sharing electrons in pairs ;
other detail e.g. H full shell has two electrons the other elements have eight ; [max 2]

[Total: 12]