

MARK SCHEME for the October/November 2014 series

**0442 CO-ORDINATED SCIENCES (US)
(DOUBLE AWARD)**

0442/33

Paper 3 (Extended Theory), maximum raw mark 120

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Page 2	Mark Scheme	Syllabus Paper
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- 1 (a) variation ;
adaptation ;
survive ;
selection ;
- (b) (i) (in 1980) no (significant) difference ;
(in 2010) higher in country **A**/ORA ; [2]
- (ii) mutation produces resistant variety ;

some bacteria more resistant than others/some bacteria are resistant ;
antibiotics in (frequent) use ;
resistant bacteria more likely to survive/natural selection/ORA ;
and reproduce to pass on this resistance ; [max 3]
- (iii) more/incorrect antibiotic use in country **A**/ORA ; [1]
- [Total: 10]**
- 2 (a) (i) 3000 (W) shown ;
 $= \frac{3000}{250}$ (= 12 A) ; [2]
- (ii) (resistance =) $\frac{\text{voltage}}{\text{current}}$;
 $\frac{250}{12} = 20.8$ or 21 ;
 Ω ; [3]
- (b) (i) (larger current so) wire moves (upwards) higher/quicker/with more force ; [1]
- (ii) (current reversed so) wire moves downwards/direction reverses/force acts downwards ; [1]
- [Total: 7]**
- 3 (a) (i) 1(%) ; [1]
- (ii) any noble gas ; [1]
- (b) (i) 24 dm³ ; [1]
- (ii) reference to the idea that 1 mole of any gas at room temperature and pressure has a volume of 24 dm³/1 mole of any gas under same conditions occupies the same volume ; [1]
- (iii) nitrogen has lower/different mass/lower density ; [1]

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- (c) (i) fractional distillation ;
- (ii) hydrocarbon / named alkane / petroleum / water ;
- (iii) $1000 \div 17 = 58.8(24)$ or 59 ;
 $58.8 \div 2 = 29.4(12)$;
 $M_r N_2 = 28$;
 $29.4 \times 28 = 823.2\text{g}$ (unit required) ;

[4]

[Total: 11]

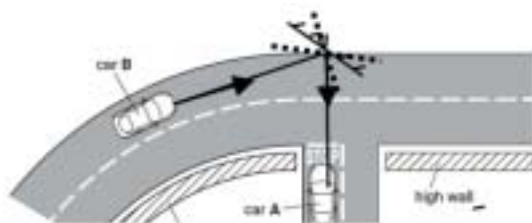
- 4 (a) (i) (positive acceleration: driving force is greater than air resistance **OR** negative acceleration: driving force is less than air resistance)
there is a resultant / net force / sum of forces is not zero ;
- (ii) (force =) mass \times acceleration ;
acceleration = $3.5\text{ (m/s}^2\text{)}$;
= $1200 \times (3.5) = 4200\text{ (N)}$;
- (iii) (KE =) $\frac{1}{2}mv^2$;
initial KE = 153 600 and final KE = 540 000 (J) ;
difference = $540\,000 - 153\,600 = 386\,400\text{ (J)}$;

[1]

[3]

[max 3]

- (b) mirror drawn at suitable angle ;



- ray of light drawn from car **B** reflects off mirror to car **A** indicated by arrow ;
angles between rays and mirror approximately correct ;

[3]

- (c) engine vibration causes air particles to vibrate ;
energy / vibrations passed from particle to particle ;
compressions and rarefactions ;

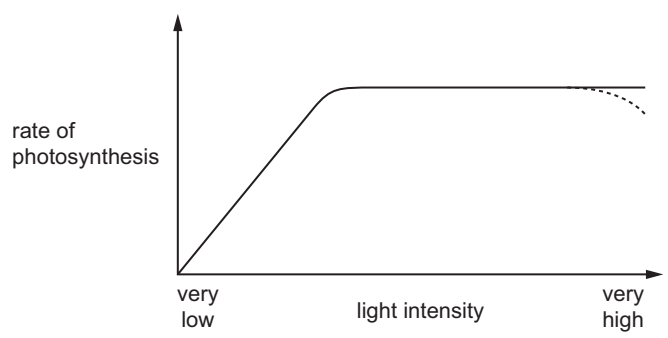
[max 2]

[Total: 12]

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- 5 (a) as an energy source ;
- (b) oxygen ;
- (c) $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
formulae ; balancing ; [2]

(d) (i)



straight line for first part of graph ;
levelling off at higher intensity ; [2]

- (ii) (at low) more light means more energy available / more light energy speeds up rate ;
(at very high) not enough CO_2 / plant photosynthesising as fast as it can / another limiting factor / limiting factor ; [2]

- (e) temperature ;
 CO_2 concentration ;
wavelength / frequency / colour of light ;
rainfall / water / humidity ;
lack of magnesium ; [max 2]

- (f) (i) chlorophyll ; [1]
(ii) to absorb the light / energy ; [1]

[Total: 12]

6 (a)

element	physical state at 20 °C	colour	formula of molecules
chlorine	gas	(pale green)	Cl₂
bromine	(liquid)	orange / brown	Br₂
iodine	solid / crystals	dark grey / black	(I ₂)

⋮

(1 mark for each correct column)

[3]

(b) chlorine + sodium iodide → iodine + sodium chloride ;

[1]

(c) become ill/be poisoned/might die ;
because harmful microorganisms would not be killed ;

[2]

(d) $2F_2 + 2H_2O \rightarrow O_2 + 4HF$
formulae ; balanced ;

[2]

[Total: 8]

7 (a) **V** = testis ;
W = ovum/egg ;

[2]

(b) fertilisation ;

[1]

(c) at **Y** = mitosis ;
at **Z** = meiosis ;

[2]

(d) **W** = 23 ;
embryo = 46 ;

[2]

[Total: 7]

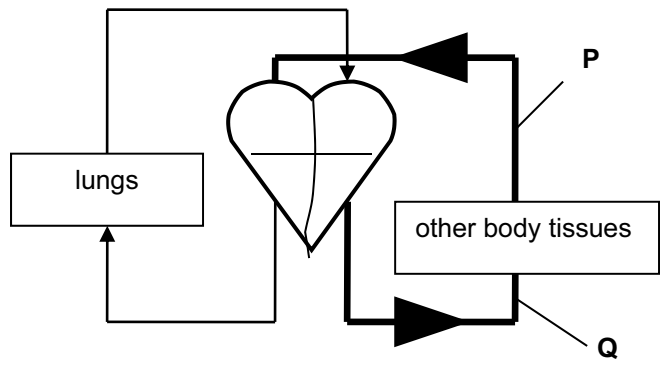
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- 8 (a) (i) 68(W) ;
- (ii) working for **A OR B** ;
A = 25% and B = 3.75% ;
- (iii) **A** is more efficient than **B**/less energy consumed ;
valid environmental statement e.g. less fossil fuels burned / non-renewable resources used / less CO₂ released ; [2]
- (b) nuclear ;
kinetic ; [2]
- (c) (i) time taken for half the atoms / nuclei to decay / time for radioactivity to fall to half ; [1]
- (ii) β particles and γ wave ;
 β more ionising ;
 β less penetrating ;
 β has charge and γ has no charge ;
 β has mass and γ has no mass ; [max 2]
- [Total: 10]
- 9 (a) (i) with ethane no colour change / stays orange ;
with ethene orange solution becomes colourless ; [2]
- (ii) x is 4 ;
y is 8 ;
alkenes ; [3]
- (b) (i) polymerisation ;
addition (polymerisation) ; [2]
- (ii) poly(ethene) ; [1]
- (iii) carbon dioxide ;
water ; [2]
- [Total: 10]

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10 (a) (i) X = pulmonary vein ;
 Y = right atrium ;

(ii)



correct arrow on P ;
 correct arrow on Q ; [2]

(iii) blood flows twice through the heart (for each complete circuit) ;
 through lungs, then through body tissues / v.v. ;
 idea of separate oxygenated and deoxygenated blood ; [max 2]

(iv) blood has less far to travel / flows through fewer capillaries / organs ;
 right (ventricle of) heart has less muscle ; [max 1]

(b) (i) artery ; [1]

(ii) surge of blood / pressure into the vessel ;
 vessel wall stretches (and recoils) with each beat ; [max 1]

(iii) more blood to muscles ;
 so more oxygen / glucose ;
 removes more CO₂ ;
 increased respiration ;
 increased energy released ; [max 2]

[Total: 11]

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- 11 (a) (i) poor (heat) conductor / idea of heat not passing through handle ;
(ii) shiny / silver surface poor heat emitter ;
- (b) *(in base of saucepan)*
increased particle movement / vibration / kinetic energy ;
energy transferred by collision, vibration / energy, passed from particle to particle ;
- (in water)*
water particles move further apart ;
less dense water rises ; [4]
- (c) (pressure =) $\frac{\text{force}}{\text{area}}$;
 $= \frac{15}{300} = 0.05 \text{ (N/cm}^2\text{)} ;$ [2]
- (d) (c =) $\frac{H}{m\theta}$ or $\frac{H}{m\Delta T}$;
 $\frac{63\,000}{(0.5 \times 30)}$;
 $= 4200 \text{ (J/kg }^\circ\text{C)} ;$ [3]
- [Total: 11]**
- 12 (a) transition metals have high density ;
transition metals (and compounds) can act as catalysts ;
transition metals (often) form coloured compounds ;
transition metals have high melting / boiling points ;
reference to variable oxidation states / valency ; [max 3]
- (b) (i) (26)
same as proton number ; [1]
- (ii) 3 ;
same as Group number ;
electrons arranged in 2,8,3 ; [max 2]
- (c) (i) aluminium atom / Al ;
becomes a positive ion ;
(aluminium atoms) lose electrons (when they ionise) / electron loss is
oxidation / electrons transferred to iron (ions) / oilrig explained ; [max 3]

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- (ii) less ;
reaction is exothermic ;
chemical energy in reactants has been transferred to surroundings / changed
to thermal energy (and so less in products) ;

[max 2]

[Total: 11]