CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

0654 CO-ORDINATED SCIENCES

0654/31 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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1 **(a)**

statement given	*word required*
a complete loop of conductors	circuit
unit of electrical current	coulomb
measures potential difference	voltmeter
used in switching circuits	relay

any **two** correct for 1 mark ;; [2]

(b) **(i)** goes out (no mark) ;
incomplete circuit ; [1]

(ii) so that they can be individually turned on and off ;
so that they all get the full mains voltage ;
so that if one fails the rest still operate ; [max 2]

(iii) $1/R = 1/R_1 + 1/R_2$;
$= 1/1.2 + 1/1.2$;
$R = 0.6\,\Omega$; [3]

[Total: 8]

2 **(a)** **(i)** **A** ;
B, **E**, **F** ; [2]

(ii) starch / cellulose / sugar / chlorophyll / any other correct ; [1]

(iii) 0.04 ; (accept 0.03) [1]

(b) feed / digest / breakdown on dead (plant or animal) material / organic matter / waste products (from plants or animals) ;
use carbon-containing substances / sugar ;
for respiration ;
return carbon dioxide to the air ; [max 2]

(c) **(i)** idea that the graph shows a maximum / optimum frequency ;
the maximum occurs at 480 ± 20 Hz ;
idea of steeper decrease than increase ; [2]

(ii) clear statement that only some earthworms have genes for response / idea of natural variation ;
worms with the genes / response are more likely to survive / escape ;
because they are less likely to be killed by moles ;
so worms with the genes / response are more likely to reproduce ;
and pass their genes to their offspring ;
over time / over many generations most worms will have the genes / response ;
[max 4]

[Total: 12]

3 **(a)** **(i)** >7 to 14 ;
<7 to 0 ;

(ii) meter is more accurate / precise / reference to quantitative ; [

(iii) add (acidified) silver nitrate / ethanoate (solution) ;
white precipitate / solid indicates hydrochloric acid / chloride (ions) ;
OR
add (acidified) barium chloride / ethanoate / nitrate (solution) ;
white precipitate / solid indicates sulfuric acid / sulfate (ions) ; [max 2]

(b) **(i)** correct transfer of electrons e.g. magnesium loses electrons / hydrogen gains electrons ;
correct linking of gain of electrons to reduction and loss of electrons to oxidation ; [2]

(ii) add acid to the mixed metals ;
reference to adding excess acid e.g. until bubbling stops ;
magnesium (reacts) / dissolves ;
copper (does not react) / does not dissolve ;
filter off the copper ; [max 3]

[Total: 9]

4 **(a)** weight / force = 600 N ;
(work done =) force x distance ;
= 600 × 1.3 = 780 J ; [3]

(b) 780 J ; [1]

(c) (power =) work / time ;
780 / 0.5 = 1560 W ; [2]

[Total: 6]

5 **(a)** **(i)** $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$;;
(left hand side and right hand side) [2]

(ii) carbon dioxide would not be absorbed ;
volume of carbon dioxide produced = volume of oxygen used ;
so no change in volume ; [max 2]

(b) **(i)** to check that movement was caused by germinating / living seeds / as a control; [1]

(ii) change in temperature / there was a small amount of carbon dioxide in the air / microorganisms on the seeds were respiring ;
(accept decomposition if linked to respiration) [1]

(iii) increased (rate of) respiration with increased temperature / positive correlation ;
10 °C rise doubles rate / use of data which shows a link between distance moved and rate of reaction; [

(iv) no movement ;
enzymes do not work at high temperatures / enzymes denatured ; [2]

[Total: 10]

6 **(a)** high rate / fast reaction needed ;
powder has high surface area ;
high surface area (of solids) increases rate / collision frequency ; [max 2]

(b) **(i)** 3 / outer electrons / shell is lost ;
so now three more positive charges (protons) than negative charges / electrons ; [2]

(ii) (not balanced)
balanced requires same number of each type of atom on both sides ;
reference to the oxygen imbalance / correct detail ;
correctly balances the equation ; [max 2]

(c) (components in) firework mixture must burn / require oxygen to burn / need to be oxidised ;
potassium perchlorate produces oxygen (when heated) ;
idea that oxygen needs to be produced in situ / air cannot easily get into firework mixture ; [max 2]

[Total: 8]

7 **(a)** **(i)** visible light ; [1]

(ii) infra-red ; [1]

(iii) microwaves ; [1]

(b) gamma not deflected ;
because gamma has no charge ;
alpha deflected one way and beta the opposite ;
because alpha and beta have opposite charges ;
opposite charges attract ; [5]

(c) **(i)** nucleus splits ; [1]

(ii) cancer / radiation burns / mutation / damages cells / damages DNA ; [1]

(iii) work behind protective screen ;
wear protective clothing ;

[Total: 1

8 **(a)** **(i)** **A** – carries sperm / semen ;
B – produces fluid for sperm to swim in / containing sugar / secretes seminal fluid ;
C – carries sperm / semen and urine ; [3]

(ii) label to testis ; [1]

(b) smaller ;
produced in larger quantities ;
more mobile ;
have a tail / pointy head / streamlined ; [max 3]

(c) gametes will fuse together ;
to produce a cell with the diploid number of chromosomes / two complete sets of chromosomes / 46 chromosomes / 23 pairs of chromosomes ; [2]

(d) virus destroys / damages / attacks white blood cells ;
reference to (T) lymphocytes / T cells;
reduces ability to destroy viruses / fight infection ; [max 2]

[Total: 11]

9 **(a)** failure to decompose the green gas ;
elements cannot be simplified / owtte ; [2]

(b) **(i)** **X** – sodium chloride ;
Y – hydrogen ;
Z – sodium hydroxide ; [3]

(ii) two atoms with shared pair of electrons between them ;
all other electrons correct / 6 unshared electrons each ; [2]

(c) **(i)** calculates M_r as 55 + (16 × 2) = 87 ;
calculates number of moles as 1.74 ÷ 87 = 0.02 ; [2]

(ii) use of equation to establish 1 : 1 molar ratio MnO_2 : Cl_2 / states that 0.02 moles chlorine will be produced ;
does the proportion sum to arrive at 24 × 0.02 ;
states answer with unit i.e. 0.48 dm^3 / 480 cm^3 ; [3]

[Total: 12]

10 **(a)** amplitude labelled ;
wavelength labelled ;
correct dimensions ;

(b) **(i)** **A** is louder than **B** ; [1]

(ii) **X** has higher pitch ; [1]

(iii)

	speed of sound / m/s
vacuum	0
solid	5000
liquid	1500
gas	330

(all correct for 2 marks, 3 or 2 correct for 1 mark) ;; [2]

(iv) compression region of high pressure / lots of (air) particles ;
rarefaction region of low pressure / fewer (air) particles ; [2]

(c) radiation ;
(only) radiation can travel through vacuum / conduction and convection need medium ; [2]

(d) **(i)** labelled where rays meet ; [1]

(ii) 59 ±1 mm ; [1]

(iii) an image which can be projected onto a screen ; [1]

[Total: 14]

11 **(a)** fats ;
proteins ;
carbohydrates ;
vitamins ; [max 2]

(b) **(i)** weak bones / soft bones / rickets ; [1]

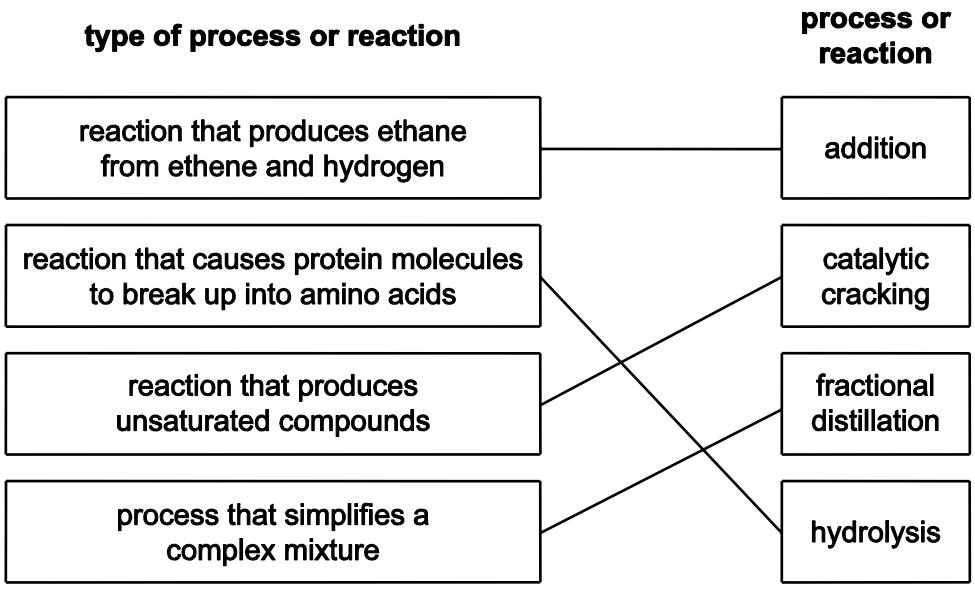
(ii) tiredness / anaemia / dizziness / faintness ; [1]

(c) bacteria ;
Lactobacillus / *Streptococcus* ;
change lactose in milk ;
to lactic acid ;
reference to sterile conditions / reference to appropriate temperature ; [max 3]

[Total: 7]

12 (a) (i) carbon and hydrogen ;

(ii)



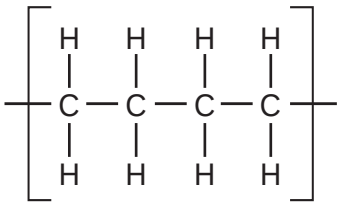
(all correct for 2 marks, 3 or 2 correct for 1 mark) ;; [2]

(b) (i) decane / alkanes does not decolorise bromine solution / bromine is only decolorised by an unsaturated substance / alkene ;
so a new product (which does) has been produced ;
new product must be unsaturated / reference to ethene / alkene ; [3]

(ii) catalysts do not undergo chemical changes / catalyst remains unchanged ; [1]

(iii) makes catalyst more efficient / work better / increases reaction rate ; [1]

(c) (i)



at least one more carbon atom with single C–C bonds ;
two H atoms bonded to each carbon ; [2]

(ii) size of molecules varies / variable chain length / owtte ; [1]

[Total: 11]