CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0654 CO-ORDINATED SCIENCES

0654/32 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.

Cambridge will not enter into discussions about these mark schemes.

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1 **(a)** **(i)** reference to positive charge on protons and negative charge on electrons ;
reference to protons – electrons = 1 ; [2]

(ii) decane is covalent / contains only molecules / no ions present ;
solid NaC*l* ions are not mobile ;
aqueous NaC*l* ions are mobile ; [3]

(iii) hydrogen ;
chlorine ;
solution becomes alkaline ;
because sodium hydroxide produced / OH^- ion concentration increases ;
because sodium hydroxide produced / OH^- ion concentration increases ;
because H^+ ion concentration decreases ; [max 4]

(b) *any two of*
sodium and chloride ions have opposite (electrical) charge ;
reference to (strong) force of attraction (between opposite charges) ;
reference to giant structure / many bonds ;
large amount of (heat) energy needed to break bonds ; [3]
(max 1 if reference to atoms / molecules or electron and sharing / covalence)

[Total: 12]

2 **(a)** **(i)** reflection ;
total internal ;
when angle is greater than critical angle / owtte ; [3]

(ii) (time) = distance / speed ;
0.03 s ; [2]

(iii) distance is less (for optical fibre / infrared) / ORA ; [1]

(b) sound waves (travel by) vibration of particles / air / medium / owtte ;
as the air is sucked out there are / is less particles / air / medium (to convey sound) ;
no particles / no air / no medium / vacuum so (sound waves cannot pass through) ; [max 2]

[Total: 8]

3 (a) (i) increased ; [1]

(ii) colour change (blue) to red ;
effervescence / (gas) bubbles produced ; [2]

(b) (i) (colour change of) cobalt chloride paper shows water and (cloudy) limewater shows carbon dioxide ; [1]

(ii) $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$ [2]
(LHS and RHS for 1 mark and balanced for 1 mark)

(iii) (paper covered with layer of) sodium hydrogen carbonate / owtte ;
provides barrier between paper and air / oxygen ;
(if paper does burn) sodium hydrogen carbonate decomposes to carbon dioxde / water which inhibit(s) burning / owtte ; [max 2]

(iv) (endothermic) heat energy has to be supplied (to keep the reaction going) ;
this heat is transferred to chemical energy / taken in to decompose the reactant / break bonds in reactant ; [2]

[Total: 10]

4 (a) (i) a change in a gene or chromosome ; [1]

(ii) ionising radiation / named ionising radiation ; [1]

(b) (i) more root hairs ;
shorter root hairs ; [2]

(ii) increase in number in both types is the same / 0.44 more root hairs per unit area ;
decrease in length is much greater in mutant plants ; [2]

(iii) reduced surface area ;
less able to take up water / mineral ions / named mineral ion ;
(reduced water) causes reduced photosynthesis ;
less glucose made ;
(less) glucose used for energy / respiration ;
for growth / building up large molecules / building cell walls ;
less nitrate (uptake reduces protein synthesis ;
less phosphate (uptake) reduces cell membrane synthesis ;
less magnesium uptake reduces chlorophyll synthesis ;
less potassium uptake reduces protein synthesis; [max 3]

(c) (i) nitrate used to make, amino acids / proteins ;
proteins needed to make new cells ; [2]

(ii) reference to eutrophication ;
nitrate leached into waterways / owtte ;
causes algal growth to increase ;
reduces light to submerged plants ;
algae / shaded plants, die ;
bacteria feed on dead algae / dead plants ;
bacteria use oxygen (for respiration) ;
which causes animals die because of lack of oxygen ; [max 4]

[Total: 15]

5 (a) $1/R = 1/R_1 + 1/R_2 / (R) = R_1 \times R_2 / R_1 + R_2$;
correct substitution ;
$R = 10/3 = 3.3\ \Omega$; [3]

(b) $I = V/R$;
$9/10 = 0.9$ A ; [2]

[Total: 5]

6 (a) **A** to placenta ;
B to amniotic fluid ;
C to cervix ; [3]

(b) oxygen comes from mother's blood ;
diffusion across / into placenta ;
blood (vessels) in umbilical cord carry oxygen to fetus ;
reference red blood cells ;
reference haemoglobin / oxyhaemoglobin ; [max 3]

[Total: 6]

7 (a) *(gaseous / a gas)*
reference to smaller / lighter molecules ;
reference to low attraction between molecules ; [2]

(b) Group 0 / noble gases ;
(gases) are inert / unreactive / very stable ;
reference to complete shells / outer octet ; [3]

(c) (i) fluoride (ion) is very unreactive ;
because has noble gas electron configuration / filled shells / outer electron octet ; [2]

(ii) M_r sodium fluoride = 42 ;
0.000064 × 42 g 1 dm^3/0.64 moles in 10000 dm^3;
(0.000064 × 42) × 10000 g = 26.88 or 26.9 or 27 g ; [3]

[Total: 10]

8 (a) (i) work done = force × distance ;
= 10000 × 1000 = 10 000 000 J ; [2]

(ii) power = work/time ;
10000000/100 = 100000 W ; [2]

(b) (force) = pressure × area ;
calculates total area of 4 tyres ; (e.g. area = 4x150 = 600 cm^2) ;
converts area to m^2 (e.g. 600 cm^2 = 0.06 m^2) ;
correct substitution in formula (e.g. force = 300000 × 0.06) ;
divides force by g (e.g. mass = 18000/10 = 1800 kg) ; [max 4]

(c) (i) copper is a good conductor of heat ;
(convection off) large surface area ;
thin pipes shorter distance for conduction ; [max 2]

(ii) energy = mass × specific heating capacity × temp change ;
= 5 × 4200 × 12 ;
= 252000 J ; [3]

[Total: 13]

9 (a) (i) white allele identified as dominant ***and*** use of capital letter for its symbol ;
small version of the same letter as symbol for himalayan allele ; [2]

(ii) *(allow whatever symbols have been chosen)*
(parents' genotypes) **Aa** and **Aa** ;
gametes **A** and **a** from both parents, ;
offspring genotypes **AA**, **Aa**, **Aa** and **aa** ;
relates genotypes to phenotypes / 3 white to 1 himalayan ; [4]

(b) (i) by respiration ;
oxygen combined with glucose ;
chemical energy in glucose transferred to / released as heat energy ; [max 2]

(ii) fur traps air ;
air, acts as an insulator / poor conductor ;
reduces heat loss by, convection / radiation ; [max 2]

(iii) ears / paws / nose, colder than other parts of body / below 25 °C ;
enzyme is active in these areas ;
black pigment produced in colder areas ; [max 2]

[Total: 12]

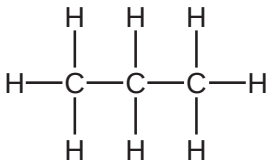
10 (a) (i) 7 ; [1]

(ii) 8 ;
covalent bonds exist between (halogen and carbon) atoms ;
which involve sharing electrons (in pairs) / each halogen atom shares an electron with carbon ; [max 2]

(b) (i) molecules in constant (random) motion ;
molecules collide (repeatedly) with paint surface ; [2]

(ii) ozone molecule has three oxygen atoms bonded and oxygen has two ; [1]

(c) (i)



;; [2]

(3 × C and 8 × H ; all C 4-valent and all H monovalent ;)

(ii) flammable (so fire risk) / so adds to greenhouse gases ; [1]

[Total: 9]

11 (a)

description	*part*
This transforms electrical impulses into sound energy	speaker ;
This transforms electrical energy to stored chemical energy	battery ;
This transforms electrical energy to light energy	screen ;
This reduces the mains voltage to a lower voltage.	charger ;

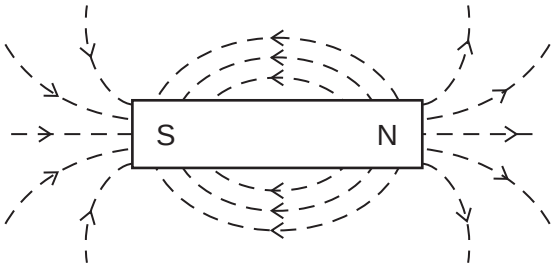
[4]

(b) (i) formula e.g. Np = Vp × Ns/Vs ;
correct substitution into correctly arranged formula/120 × 40/6 ;
= 800 turns ; [3]

(ii) transmits changing magnetic field ; [1]

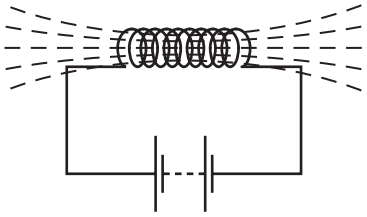
(iii) (high voltage) means low current ;
less energy lost as heat ; [2]

(c) (i)



shape ;
arrowheads ; [2]

(ii)



lines passing through coil ; [1]

[Total: 13]

12 (a) carbon monoxide
tar
particulates / smoke <u>particles</u>
nicotine
4 correct = 2 marks, 2 or 3 correct = 1 mark ;; [2]

(b) mucus not swept upwards / away from lungs ;
mucus accumulates in, lungs / alveoli ;
bacteria breed in mucus ; [max 2]

(c) phagocytes engulf bacteria ;
digest them / kill them ;
lymphocytes, secrete / produce, antibodies ;
which attach to bacteria and help to destroy them ; [max 3]

[Total: 7]