UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2011 question paper

for the guidance of teachers

0652 PHYSICAL SCIENCE

0652/31 Paper 3 (Extended Theory), maximum raw mark 80

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 must be read in conjunction with the question papers and the report on the examination.

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1 (a) 50 m/s ;

(b) acceleration/deceleration/slowing down ;
constant/steady referring to acceleration/deceleration (**not** at constant speed)/calculated value of acceleration/comes to rest ; [2]

(c) (i) use of gradient, $(a = (30 – 0)/(10 – 0))$;
3.0 m/s^2 ; [2]

(ii) use of $F = ma = 1500 × 3.0$ (e.c.f.) ;
$= 4500 \text{ N}$; [2]

(iii) mention of frictional force/air resistance ;
force from engine = accelerating force + frictional force/work done against friction ; [2]

(d) (car **B**) ;
larger gradient/same mass (**not** accept shorter period of time) ;
greater acceleration/deceleration ; [2]
(both marks can be scored for a correct calculation of both accelerations and comment)

[Total: 11]

2 (a) (i) $2NO + 2CO \rightarrow N2 + 2CO_2$
all formulae correct ;
balanced ; [2]
($NO + CO \rightarrow N + CO_2$ max 1)

(ii) nitrogen (monoxide) is reduced because it has lost oxygen ;
carbon (monoxide) is oxidised because it has gained oxygen ; [2]
(marks can be gained for correct reference to electron loss and gain/oxidation states)
(1 max if general explanation without reference to NO and CO is given)

(iii) any two:
(percentage) of nitrogen monoxide has decreased ;
(percentage) of nitrogen has increased ;
(percentage) of carbon monoxide has decreased ;
(percentage) of carbon dioxide has increased ; [max 2]

(iv) carbon monoxide reacts with oxygen to form carbon dioxide/hydrogen reacts with oxygen to form water ; [1]
(**if** the carbon monoxide to carbon dioxide process is not scored in **(iii)** it can score here)

(b) (i) galvanising means coating with zinc ;
zinc more reactive than steel/iron ;
zinc reacts not iron/sacrificial reaction ; [3]

(ii) painted steel will rust if scratched or chipped but galvanised will not (rust) ;
(both required, but allow the comment re zinc not reacting if included in **(i)**)

[Total:]

3 (a) the band vibrates ;
causing air (molecules) to vibrate / forming a longitudinal / compression wave <u>in the air</u> ;   [2]

(b) 4.5 or 5 waves number of waves or specified number of divisions ;
4.5 in 4 divs (accept 5 waves in 5 divs) ;
$f = 450$ (Hz) ;   [3]
(allow rounding errors for answer) (use of only one wave – 2 max, raw answer 400 Hz – 2 max)

[Total: 5]

4 (a) (i) light provides <u>energy</u> ;   [1]

(ii) reduction is gain of an electron / oxidation state goes down ;   [1]

(iii) $Ag^+ + e^- \rightarrow Ag$;   [1]

(b) (i) add potassium bromide solution to silver nitrate solution until no further reaction ;
filter (to obtain ppt) ;
wash <u>ppt</u> with distilled water ;
leave <u>ppt</u> to dry ;
keep in dark ;   [max 4]

(ii) $AgNO_3 = 170$ and $AgBr = 188$;
number of moles = $\dfrac{5}{170}$ (accept $\dfrac{5}{188}$) ;
= 5.5 g ;   [3]

[Total: 10]

5 (a) (i) use of $I = V/R$ (= 6 / 48) ;
= 0.125 A (0.13 A) ;   [2]

(ii) (e.c.f.) use of $R = V/I$ (= 4.5 / 0.125) ;
= 36 Ω ;   [2]

(b) $R = V/I = 3.0 / 0.125 = 24$ Ω / discussion re ½ potential difference leads to ½ R ;   [1]

(c) (i) use of $1/R = 1/R_1 + 1/R_2 = 1/24 + 1/8 = 4/24$ (accept sum / product) ;
$R = 24/4 = 6$ Ω ;   [2]
(<u>must</u> show R = 6 Ω)

(ii) $(6 + 24 =) 30\ \Omega$;

(iii) (e.c.f.) current $= 6/30 = 0.2$ A ;
potential difference $= 0.2 \times 6 = 1.2$ V ; [2]

(iv) dim / not properly lit if potential difference < 3, bright if potential difference > 3, normal if potential difference = 3 ; [1]

[Total: 11]

6 (a) $CaCO_3 = 100$;
number of moles $= \dfrac{2.5}{100}$ or 0.025 ;
$= 0.6\ dm^3$; [3]

(b) (i) calcium oxide is a base because it gains a proton / the oxide ion gains a proton ;
hydrochloric acid is an acid because it donates a proton ; [2]
(max 1 if neither refers to specific reaction)

(ii) amphoteric ;
acidic ;
neutral ; [3]

[Total: 8]

7 (a) (i) the needle of the voltmeter moves ;
then goes back to zero ;
(do **not** allow if there is a residual current. e.g. needle falls to zero) [2]

(ii) when the magnet moves the coil cuts / there is a <u>change</u> in magnetic flux ;
which <u>induces</u> an e.m.f./current ; [2]

(b) the needle of the voltmeter moves in the opposite direction ; [1]

(c) wave trace seen on the cathode ray oscilloscope ;
changing current produces changing field ; [2]

[Total: 7]

8 (a) (i) noble gases (do not accept inert, rare) ; [1]

(ii) boiling point increases / density increases / mass increases ;
with increasing atomic number / down group ; [2]

(iii) unreactive (accept inert) ; [1]

(iv) any value between 4.5 and 9.9 kg/m^3 ; [1]

(b) (i) diagram showing 8 electrons in outer shell ;
3 shells with 2 electrons in first shell and 8 in second shell ;   [

(ii) potassium, 1+ **OR** chloride, 1− ;;   [2]

(iii) loses electrons ;
two electrons are <u>lost</u> ;   [2]

[Total: 11]

9 (a) (i) liquid turns to vapour / gas (<u>not</u> molecules) ;   [1]

(ii) boiling: bubbles of vapour form in the liquid ;
evaporation: molecules leave the surface of the liquid ;
OR
boiling occurs at fixed temperature ;
evaporation at a range of temperatures 1 ;   [max 2]
OR
boiling is a violent process (1 max) ;

(b) 15 – 25 °C ;   [1]

(c) molecules lose energy / slow down etc. ; (not accept **molecules** lose **thermal** energy)
clear energy loss is loss in <u>kinetic</u> energy / energy is transferred to the surroundings / <u>hence</u> temperature falls ;   [2]

[Total: 6]