**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

**UNIVERSITY** *of* **CAMBRIDGE**
International Examinations

**1** **(a)** 50 m/s ;                                                                                    [1]

**(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)) ;
$3.0 \text{ m/s}^2$ ;                                                                  [2]

**(ii)** use of F = ma = 1500 × 3.0 (e.c.f.) ;
= 4500 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) ;     [1]
           (both required, but allow the comment re zinc not reacting if included in **(i)**))

                                          **[Total: 11]**

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

    **(b)**  $R = V/I$ = 3.0 / 0.125 = 24 $\Omega$ / 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 $\Omega$ ;        [2]
           (<u>must</u> show R = 6 $\Omega$)

    **(ii)** (6 + 24 =) 30 $\Omega$ ;                                              [1]

    **(iii)** (e.c.f.) current = 6 / 30 = 0.2 A ;
potential difference = 0.2 × 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 ;                                    [2]

   **(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]**