UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education O Level

MARK SCHEME for the JUNE 2005 question paper

5054 PHYSICS

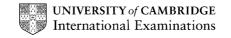**5054/02   Paper 2 (Theory), maximum mark 75**

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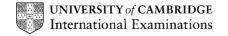**UNIVERSITY *of* CAMBRIDGE**
International Examinations

June 2005

GCE O Level

MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 5054/02

PHYSICS
Paper 2 (Theory)

UNIVERSITY *of* CAMBRIDGE
International Examinations

Section A

1 **(a)** arrow from Earth to Sun (by eye would pass through Sun)   **B1**

    (b) (i) use of circumference/time **or** s=d/t **or** radius/t   **C1**
        two speeds **clearly** found using circumference e.g. 970 and 942
        (allow conversion to other units)   **A1**

        (ii) 258 (million km)   **B1**   **4**

2 **(a)** straight line through optical centre by eye   **M1**
    one other line from same point on object correctly to image on film   **A1**

    (b) move lens towards object/to left/away from film   **B1**

    (c) **1st and 2nd face** correct refraction for all rays shown   **B1**
    dispersion into at least two rays at first face only   **B1**
    colours marked on diverging rays outside prism
    (any 2 visible colours from spectrum, any order, accept letters)   **B1**   **6**

3 **(a) (i)** (molecules) hit the wall/cylinder   **B1**
        any other point to explain large pressure, e.g. small distance between
        molecules **or** hit often/frequently **or** many hit walls each sec **or** hit/move fast   **B1**

        (ii) greater distance between molecules **or** fewer hit (per sec) **or** fewer molecules
        (in cylinder) **or** molecules leave cylinder   **B1**

    (b) $P_1V_1 = P_2V_2$ **or** PV = constant   **B1**
    0.002. 200 = 1. V or 0.4 seen   **C1**
    0.398 **or** 0.4 m^3 **A1** **6**

4 **(a)** in river/(emerging from or entering) turbine house   **B1**

    (b) (i) 0.9 **or** 90% **or** 0.47 **or** 47% (penalise unit error)   **B1**

        (ii) P = E/t in symbols **or** any energy/any time   **C1**
        30 x 60 **or** 1800 seen   **C1**
        2.5×10^6 (W)
        (150 or 2.78MW score 2/3)   **A1**

    (c) any sensible suggestion e.g. no costs for water/energy supply
    or less pollution (accept coal produces smoke/dust/harmful gases/CO_2
    or no need to transport coal **or** renewable
    or rapid response to power demand **or** less heat produced/more efficient   **B1**

    (d) any sensible suggestion e.g. flooding **or** fish unable to pass **or** turbines kill fish
    or destroy habitats **or** less land **or** uses up large space **or** fells trees
    or unsightly/destroys scenery **or** lake/river silt up **or** more rain/evaporation   **B1** **7**

5 **(a)** arrows in A and C to right   **B1**
    arrow in B to left **or** right if both A and C to left   **B1**

    (b) (i) SNSN **or** NSNS   **B1**

  (ii) they/iron pieces attract/move together e.c.f. **(i)** throughout **B1**
    attraction of opposite poles/unlike poles/S and N **B1**

 (c) (i) opposite direction/reverses/poles change **B1**

  (ii) weaker (field) **or** (iron) demagnetises **B1 7**

6 **(a)** 3024 **B1**
  3.024 (or1/1000 of previous answer) **B1**
  1.512 (or ½ of previous answer) **B1**

 (b) smaller resistance **accept** more current **B1**

 (c) heater uses more than 3A **accept** current 12.6A **B1**
  causes fuse to melt/blow/burn/break **B1 6**

7 **(a)** arrow anticlockwise anywhere near top line of circuit **B1**

 (b) LDR **or** light dependent resistor **B1**

 (c) less resistance of X **B1**
  same change in voltage as resistance
  (voltage decreases alone B1) **B1 4**

8 **(a)** 4.5 V **B1**

 (b) I =V/R in any form using symbols or words **B1**
  4.5/15 **C1**
  0.3 A **A1**

 (c) provides smaller (internal) resistance **or** lasts longer **or** less lost voltage
  or one (cell) fails others work **or** less heat/energy lost **B1 5**

Section B

9 **(a) (i)** y axis labelled speed or m/s **and** x axis labelled time or s **B1**
   straight line from 0,0 to t = 20, speed = 25 **B1**
   uniform speed from t = 20 to 50 **and** uniform deceleration from t = 50 to 60 **B1**

  (ii) acceleration = change in velocity/time or per unit time
   or rate of change of velocity with time
   accept equation but must be written in words or defined symbols **B1**

  (iii) constant increase in speed/velocity in 1sec/ /same time interval
   or rate of change of speed/velocity constant **or** Δv proportional to time
   or acceleration constant **with time** **B1**

  (iv) 25/10 e.c.f. time interval from graph **C1**
   2.5 m/s^2 accept -ve **A1**

(b) (i) weight/gravitational force (accept gravity) **downwards**
normal/reaction/contact force/force from ground **upwards**
air resistance/drag **or** friction (due to air) **backwards or** opposite to train (direction)
braking force **or** friction **or** resistive force **backwards or** same direction as air drag
tractive **or** thrust **or** driving force **or** force of engine **forwards**

ANY 4 **B4**

accept from diagram (-1 each wrong force more than 4)

(ii) 1. unbalanced **since** forward force > backwards force **or** resultant/net **forward** force **B1**
2. balanced **since** forward force = backwards force **or** forces cancel **or** zero resultant **B1**
3. unbalanced **since** backwards force > forwards force
or only backwards force **or** resultant/net backwards force **B1**
accept sizes of forces from lengths of arrows on diagram

(c) sketch graph with **axes labelled** and non straight line **B1**

10 (a) (i) 25% **B1**

(ii) conduction through roof
particles/molecules/atoms vibrate (accept electrons move if roof metal) **B1**
(energy passed) from particle to particle (by collision)
or no net movement of medium **B1**
convection from roof
(warm) air (in contact with roof) expands (ignore particles expand) **B1**
(air) density decreases **B1**
hot air (not heat) rises **B1**
radiation from roof
sensible comment on radiation, e.g. infra-red, electromagnetic, a wave **B1**

(iii) (carpet) traps air **B1**
carpet/air is a bad conductor/good insulator
or convection reduced **in trapped air** **A1**

(b) (i) X = ($) 800 **B1**
Y = ($) 100 **B1**

(ii) B (allow 1 mark for e.c.f. from (i)) **M1**
comparison of installation cost **or** energy saving/year **or** payback time **A1**

(iii) walls thicker/cavity insulation/insulated/made from insulating material
floors thicker/made from insulating material (e.g. polystyrene, wood)
painting walls/roof white (inside or outside)
draught prevention/closing windows/closing doors/stop (hot) air escaping
using curtains/shutters
fewer windows/double glazing windows
reducing temperature inside house   ANY 2, 1 from each line **B2**
(ignore insulating roof)

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11 (a) (i) nucleus or small central area shown on diagram   **M1**
              containing neutrons and protons   **A1**
              electrons in orbits (accept shown on diagram around nucleus)   **B1**

       (ii) emission of at least one of alpha/beta/gamma (radiation/particles)
             random or spontaneous (emission)
             from **unstable** atom/nucleus/substance **or** becomes stable   ANY 2   **B2**
             from nucleus   **B1**

       (iii) sensible statement but not just a list of the causes of background radiation
             e.g. unavoidable **or** naturally occurring **or** from surroundings/environment **or**
             present without source **or** there all the time etc.   **B1**

       (iv) any halving **or** 820 **or** 419 **or** 410 **or** 223 **or** 209(.5) **or** 210 **or** 2 half lives
             seen   **C1**
             205   **A1**

     (b) (i) 84   **B1**
             proton number increases by 1 **or** n -> p + e **or** correct equation with $_{-1}\beta$ or $_{-1}e$ **B1**

       (ii) alpha   **B1**
             loses two protons or proton number or atomic number decreases by 2   **B1**
             loses two neutrons or nucleon number or mass number decreases by 4   **B1**

       (iii) different proton numbers   **B1**

Max 1 unit penalty per question. No significant figure penalties.