Cambridge International Examinations
Cambridge Ordinary Level

Cambridge O Level

PHYSICS	**5054/21**
Paper 2 Theory	**May/June 2016**
MARK SCHEME	
Maximum Mark: 75	

Published

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1 **(a)** air resistance is zero   **B1**
or no air resistance acts (at first)
or weight <u>much larger</u> than air resistance

        (a=) F / m **or** weight / mass **or** 600 / 60   **B1**
        or weight is 10 times mass

    (b) air resistance / upwards force is larger than weight / 600 N / downwards force   **B1**

    (c) **(i)** 5(.0) m / s   **B1**

        (ii) 120 N   **B1**

2 **(a)** **(i)** limit of proportionality   **B1**

        (ii) 250 g   **B1**

        (iii) 2.5 N   **B1**

    (b) half the extension / 10 cm   **B1**

        each / both / another spring shares / distributes the weight / mass   **B1**
        or both springs bear / carry the load

3 **(a)** **(i)** amount of matter / substance / material   **B1**
              or the ability of an object to resist a change in its state of motion
              (when a force is applied)

        (ii) (V=) M / D in any form numerical or algebraic   **C1**
             0.13(19) cm^3 **A1**

        (iii) V / ($l \times$ w) in any form numerical or algebraic   **C1**
             0.022 cm   **A1**

    (b) micrometer (screw gauge) **or** calipers   **B1**

4 **(a)** **greatest** air; **least** copper   **B1**

(b) (i) 1 difference between smallest and largest temperature **B1**
   or from 0 to 100 °C

   (i) 2 small/moderate distance between (thermometer) marks **B1**
   or for a given temperature change there is a small expansion of liquid / distance
   (along scale) / change in thermometric property
   or cannot measure small temperature <u>difference / change</u>

   (ii) • use liquid that expands more **B1**
   • smaller bore / thinner tube
   • more mercury (in bulb) **or** use larger bulb

5 (a) *sound:* along or parallel (to transfer of energy or wave) **and** longitudinal **B1**

   water: perpendicular **and** transverse **B1**

   (b) (i) 0.29 – 0.28 m **B1**

   (ii) <u>time / period</u> for one wave(length) / cycle constant **B1**
   or each oscillation / cycle takes one second

6 (a) angle of incidence **B1**

   smallest angle for light to be totally internally reflected **B1**
   or largest angle (of incidence) for ray to be refracted / emerge
   or when light emerges along surface
   or when angle of refraction is 90°

   (b) (i) n = 1 / sinC algebraic or numerical **C1**
   2.5 **or** 2.46 **or** 2.458(59) **A1**

   (ii) *left hand diagram* ray refracts away from normal and emerges into air at bottom left
   surface **B1**

   right hand diagram reflected horizontal ray (by eye) **B1**

   right hand diagram rest of ray completely correct to emerge into air at top face
   without refraction (by eye) **B1**

7 (a) (current in coil) creates magnetic field **C1**
   or current is at right angles to magnetic field (of permanent / cylindrical magnets)

   (b) into and out of magnet **B1**
   or left and right
   or backwards and forwards

   current is one way then reverses (so reverses force) **B1**

(c) ($\lambda=$) v/f numerically or algebraic in any form   C1
   0.64 m   A1

8   **(a)**   **(i)**   same / equal **or** $I_B = I_1 = I_2$ B1

       (ii)   (p.d. of) battery is sum of (p.d. across) fixed resistor and (p.d. across) the variable
             resistor   B1
             or $V_B = V_1 + V_2$

    (b)   (I=) V/R numerical or algebraic in any form   C1
        0.006(0) A   A1

9   **E**   **(a)**   2 squares   C1
           10 V   A1

      (b)   measure / find horizontal distance / number of divisions (between points)   C1
           distance $\times$ no (m)s / division   A1

   OR   **(a)**   transistor   B1

         (b)   (in dark) resistance of LDR large / increases   B1
              large voltage across base (and emitter)   B1
              switches transistor on   B1
              or current in <u>collector</u> increases

10   **(a)**   **(i)**   temperature   B1
            when solid turns to liquid   B1

         (ii)   molecules escape (surface)   C1
            fastest molecules / most energetic molecules   A1
            escape / break bonds
            leaving behind slower molecules / colder molecules   B1
            or temperature falls

      (b)   **(i)**   at the surface / top of liquid   B1

         (ii)   less heat / energy <u>enters</u> (liquid nitrogen) / transfers
            or less nitrogen evaporates / boils   B1
            reduces / stops conduction **and** convection   B1
            explanation of no conduction or convection, e.g. no molecules / no medium   B1

(c) **(i)** nitrogen gas **or** nitrogen vapour   B1

    (ii) **1**   (Q=) mcT numerical or algebraic   C1
                216 (°C) seen   C1
                4200 J   A1

    (ii) **2**   (m=) Q / L numerical or algebraic   C1
                21 g   A1

11 **(a)** **(i)** diagram showing coil of wire and either   B1
- magnet or
- another coil and supply (dc and switch or ac)

        coil of wire connected to an ammeter or voltmeter or cro or other method of
detection, e.g. lamp   B1

        magnet or coil moved   B1
        or <u>change in current</u> mentioned if another coil used

    (ii) ANY 2 from   B2
- move magnet (or coil) faster
- larger current in primary (if transformer drawn)
- more turns in coil
- stronger magnet (if magnet drawn)
- soft iron core

    (iii) **1**   direction of <u>induced</u> current / <u>induced</u> emf   B1
                opposes the change (that produces it)   B1

    (iii) **2**   (magnetic) flux / field / poles in coil caused by movement / (induced) current in   B1
                coil

                statement of how opposition occurs, e.g. repulsion as magnet moves in; N pole   B1
                created (by induction) at end of coil as N pole approaches

  (b) **(i)** **1**   (I=) P / V numerical or algebraic   C1
                15(.15) A   A1

        2   (E=) Pt **or** VIt **or** 500(000) $\times$ 60 $\times$ 60   C1
                1.8×10^9 J **or** 500 kWh   A1

    (ii) low current   B1
        P = I^2R **or** E = I^2Rt explained   B1

12 (a) kinetic energy at start   B1
 thermal energy / heat energy / internal energy at end   B1

(b) (i) 0.4(0) s   B1

 (ii) (d=) s × t numerical or algebraic   C1
 2.8 m   A1

 (iii) area under graph (between 0.4 and 2.4 s)   B1
 or time (difference) × <u>average</u> speed
 or ½ × time (difference) × initial speed

 (iv) horizontal line from (0,5) to (0.4,5)   B1
 line showing braking with same gradient as original line   B1

 (v) less friction   B1
 less deceleration **or** graph less steep   B1
 or less <u>force</u> <u>backwards</u> / less <u>force</u> <u>opposing motion</u>
 or same KE lost / work done by friction

 longer time to stop   B1
 or larger area under (speed-time) graph
 or work = force x distance applied correctly

(c) (i) (F=) P × A numerical or algebraic   C1
 60 N   A1

 (ii) same pressure   B1
 larger area (of S / brake pads)   B1