PHYSICS **5054/22**

Paper 2 Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 75

Published

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This document consists of **5** printed pages.

Section A

1 (a) $(v = u +)at$ **or** 3.4×5.0 C1
     17 m / s   A1

(b) (i) 0 **or** zero **or** no resultant force   B1

     (ii) straight line of positive gradient from (0, 0)   B1
     horizontal line at v > 0 **and** after initial acceleration   B1
     straight line from (0, 0) to (5.0, 17) **and**
     straight line from (5.0, 17) to at least (15.0, 17)   B1

     (iii) calculate the area **under** the graph **or** area of trapezium   B1   [7]

2 (a) (i) (GPE =)mgh **or** $45 \times 10 \times 1.8$ B1
     810 J   B1

     (ii) kinetic either order   B1
     thermal / internal / heat / sound } either order   B1

(b) (i) upwards / centripetal / towards centre (of circle)   B1

     (ii) it / weight less (than normal contact force) **or** upward force greater   B1   [6]

3 (a) (i) 20 N   B1

     (ii) 1. $(\Gamma =)Fd$ **or** 20×0.35 **or** 20×0.70 **or** 14   C1
     7.0 N m   A1

     2. friction (at hinge / seal) **or** air resistance **or** to cause an initial acceleration   B1

(b) (for other directions) **perpendicular** distance is less   B1   [5]

4 (a) temperature at which liquid / water turns to gas / vapour / steam   B1

(b) (i) ($T =$)24 (°C) **or** 100 – 24 **or** 76   C1
     ($\Delta Q =$)$mc\Delta T$ **or** $1.5 \times 4200 \times 76$ C1
     4.8×10^5 J   A1

     (ii) heat is lost (to the surroundings) **or** evaporation   B1
     at higher temperatures heat is lost at greater rate   B1

(c) (i) stays at 100 °C / constant   B1

     (ii) molecules separate / are pulled apart / are far apart / break bonds /
     overcome forces of attraction   B1
     work done separating the molecules **or** molecules gain PE   B1   [9]

5 **(a)** atoms / molecules / particles move / collide   B1
atoms / molecules / particles collide with walls / piston   B1
collisions cause forces   B1

   (b) $(p_2 =)p_1V_1 / V_2$ **or** $1.1 \times 10^5 \times 40 / 110$ C1
4.0×10^4 Pa   A1   [5]

6 **(a)** any **three** of:
filament is heated / hot **or** thermionic (emission) mentioned
<u>electrons</u> negative **or** <u>electrons</u> escape / are emitted
electrons attracted / accelerated by a <u>positive charge</u> / <u>high potential</u> / <u>anode</u>
opposite charges <u>attract</u> **or** positive (anode) <u>attracts</u> negative (electrons)   B3

   (b) no collisions with air / particles **or** allows electrons to reach the screen   B1

   (c) electron beam is a current **or** moving charges   M1
deflected by a magnetic <u>field</u> **or** experience force in magnetic <u>field</u>   A1   [6]

7 **(a)** 94 electrons **and** 94 protons   B1
144 neutrons   B1
(only) electrons in orbit / surrounding nucleus **or** (only) protons
and neutrons in nucleus   B1

   (b) **(i)** (beta-particles) weak(er)   B1
(beta-particles) strong(er)   B1

      (ii) any **two** lines from
glasses / goggles **or** lead container / shield / clothing / gloves
tweezers / manipulator / carry in large cardboard box
minimise time of exposure / <u>film</u> badge   B2   [7]

                                                     [45]

Section B

8 (a) (i) 0.83 – 0.86 N   B1

(ii) line curved   B1
line (curved) upwards   B1   [3]

(b) (i) ($P =$)$h\rho g$ C1
$0.035 \times 1000 \times 10$ **or** $3.5 \times 1000 \times 10$ **or** $35 \times 1000 \times 10$ C1
350 Pa   A1

(ii) ($F =$)PA **or** 350×0.0016 **or** 350×16 **or** 5600   C1
0.56 N   A1

(iii) 1.4 N **or** (a)(i) $+$ (b)(ii) calculated   B1   [6]

(c) (i) (atmospheric pressure) exerts a downward force / pressure   B1
(on top of the block)
(cancels out the) extra upward force / pressure   B1

(ii) (vector) has direction (in addition to magnitude)   B1   [3]

(d) any **three** lines from
force due to water increases
force due to spring decreases
increased pressure (at base)
they add to give a constant value / weight of block **or** total force constant   B3   [3]

                                                                                        [15]

9 (a) rate of flow of charge **or** charge flowing per unit time   B1   [1]

(b) (i) 7.5 V   B1

(ii) ($R =$)V/I **or** $7.5/4.0$ C1
1.9 Ω A1

(iii) ($P =$) VI **or** 6.5×4.0 C1
26 W   A1

(iv) resistance increases   M1
(reading of ammeter) decreases   A1   [7]

(c) (i) at least two lines on left **and** two lines on right of core **and**
correct shape (by eye)   B1
good shape (by eye) **and** into poles **and** no straight sections **and**
at least one line on each side   B1
at least one arrow N to S (primarily upwards) **and** none wrong   B1   [3]

(ii)	**1**	cylinder is magnetised (by induction)	B1	
		top (of cylinder) is an S-pole	B1	
		unlike poles attract **or** S-pole attracts N-pole	B1	
	2	it does not (remain in contact) **and** iron is temporary / soft magnetic material / core (and cylinder) lose magnetisation	B1	[4]

[15]

10 (a) (i) 3.0×10^8 m / s   B1

   (ii) $(\lambda =)c / f$ **or** $3.0 \times 10^8 / 4.3 \times 10^{14}$ C1
   7.0×10^{-7} m   A1   [3]

(b) (i) decreases   B1

   (ii) $\sin(i) = n \times \sin(r)$ **or** $1.5 \times \sin(30°)$ **or** 0.75   C1
   49°   A1

   (iii) 41°   B1   [4]

(c) (i) dispersion at **both** surfaces **and** refractions in correct direction   B1
   violet / blue light below the red light shown   B1

   (ii) spectrum **or** band of (continuous) colours **or** colours of rainbow   B1
   red, orange, yellow, green, blue, (indigo, violet)   B1

   (iii) 1 X marked above red   B1
   2 it is / black surfaces are good absorbers (of IR radiation)   B1   [6]

(d)

intruder / human being emits IR	IR beam broken	IR reflected	B1	
or		**or**		
intruder warm **or** IR detected	does not reach detector	change detected	B1	[2]

[15]