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PHYSICS **5054/22**

Paper 2 Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 75

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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 thermal / internal / heat / sound } either order	B1 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]

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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]

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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 × 1000 × 10 **or** 3.5 × 1000 × 10 **or** 35 × 1000 ×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 (on top of the block)	B1	
			(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]

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(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) (λ =)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 × sin(r) **or** 1.5 × 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]

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