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Edexcel GCE

Physics
Unit no. 6736

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Mark Scheme (Results)

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Physics
6736

6736 Unit Test PHY6

1. (a) Graph

Line from origin curving towards (horizontal) ✓

becoming horizontal and terminal velocity marked ✓

(i) Fluid/liquid/gas [do **not** accept air] ✓

Resistive/drag forces for (movement) through it ✓

(ii) Charge comes in multiples of a basic charge/*e* ✓ **5**

(b) (i) Use of $\frac{4}{3}\pi r^3 \rho g$ ✓

Correct answer [$W = 1.86 / 1.9 \times 10^{-14}$ (N)] to at least 2sf ✓
[Watch out for 10^{-5} followed by 'right' answer – loses second mark][Do not credit bald answer] [no ue]

(ii) Use of $4/3\pi r^3 \rho' g$ as buoyant force [could be implied] ✓

Recognition of $\rho' \div \rho$ *OR* $U = 2.4 \times 10^{-17}$ N ✓

Hence $U/W = 0.13$(%) [no ue] ✓
[allow use of 2×10^{-14} giving 0.12%]

(iii) $4/3\pi r^3(\rho - \rho')\, g = 6\pi r \eta \upsilon$ ✓

Hence $r = \sqrt{\dfrac{9\eta\upsilon}{2g(\rho - \rho')}}$ ✓ **7**
[accept any equivalent of 9/2 e.g. 18/4; accept substitution into $(\rho - \rho')$]

(c) (i) Sketch: ≥ 3 vertical lines ✓
[ignore curved lines at edges and central gap]
Arrows down/consistent with ± ✓

(ii) Rearrangement of $E = V/d \Rightarrow V = Ed$ ✓

$\Rightarrow V = 780$ V ✓

(iii) E.m.f. = 2 × 780 V / 1560 V [ecf their V] ✓

Assume: (power) <u>supply</u> has zero resistance **or** no internal resistance **or** voltmeter has infinite resistance ✓ **6**

(d) ≥ 2 sets of values correctly read from graph ✓
[eg (7.4, 5) (8.5 or 8.6, 4) (10.2, 3) (13.8-14.0, 2)
eg (8, 4.4) (10, 3.1) (12, 2.3-2.4) (14, 2.0) (7, 5.4)]

Range of at least 2 N ✓

Correct method [e.g. multiplied together / calculate *k* and use to compare predicted to actual value] [ignore 10^n error] ✓

Hence conclusion: not proportional ✓ **4**
[consequent mark, no ecf from using close values or wrong method]

(e) [Accept symbols/words/formulae throughout part (e)]

(i) 

(ii) 

Identify weight **down AND** buoyancy (force) **up** on **both** diagrams [do **not** accept gravity] ✓

Identify electric (force) **up** on (i) [Allow electric field] ✓

Identify viscous (force) **up** on (ii) ✓

[Accept 2 labels on 1 **up** arrow]

(i) $W = B + F_e$ ✓
[Accept any correct rearrangement]

(ii) $W = B + V$ ✓ **5**
[Accept any correct rearrangement]

(f) Mention of ionising/ionisation ✓

Comment on a relevant property of α **and** γ ✓ **2**

(g)	Diagram:	Downward **drift** [curves/wiggles OK]	✓	
		[not straight down]	✓	
		Non-equal straight lines	✓	
		At random angles	✓	**5**
	Explanation:	Droplet is bombarded	✓	
		by <u>air</u> molecules		**34**
		[1/2 for stating Brownian motion without further detail]		

2.	(a)	Quality of written communication	✓	
		Protons drift/move uniformly inside tubes	✓	
		Accelerate **between** the tubes/in the **gaps**	✓	
		Alternating p.d. reverses while p is **in** tube	✓	
		The tubes must get longer as p speeds up	✓	
		For time inside tube to be constant **or** to synchronise movement with the pd	✓	**Max 5**

(b) (i) Multiply by 419 or 420 ✓

Multiply by 1.6×10^{-19} ✓

Correct answer to at least 2 sf ✓
[$5.36/5.38/5.4 \times 10^{-11}$ (J)] [no ue]

Δm = energy ÷ (9.0×10^{16} m^2 s^{-2}) ✓
[ecf their energy or 5×10^{-11}]

$\Delta m \div 1.01 \times 1.66 \times 10^{-27}$ kg [ecf their Δm] ✓

Correct answer ✓ **6**
[0.36 or 36%] [Use of 5×10^{-11} gives 33%]

[Accept routes via Δm in u and m_p in J]

(ii) Use of $1/f$ ✓

$\therefore$ time down linac = $420 \div 3.9 \times 10^8$ s^{-1} ✓
or $210 \div 3.9 \times 10^8$ s^{-1} **2**

[$t = 1.07/1.08/1.1 \times 10^{-6}$ (s) or 0.54×10^{-6} (s)]

(c) (i) Fixed target:

Large(r) number of /more collisions **or** more likely to get collisions [**not** easier to get collisions] ✓

Other particle beams produced ✓

(ii) Colliding beams:

More energy available for **new particles** ✓

$p = 0$ so all energy available ✓ **Max 2**

15

3. (a) Mention of natural frequency (of water molecules) ✓

At f_0 there is a large/increased **amplitude** ✓

and hence max energy transfer / max power transfer / max efficiency / max heating ✓ **3**

(b) (1.2 kg)(3200 J kg^{-1} K^{-1})(75 K) seen ✓

$\Rightarrow$ 288 kJ

÷ 600 s to give a power in W [$\Rightarrow$ 480 W] ✓

Efficiency 480 W e.c.f ÷ 800 W [= 60%] ✓

There will be heat/energy/power losses from the meat/to the surroundings or water evaporation needs LHV or water evaporation leaves fewer molecules to vibrate ✓ **4**

(c)	(i)	See $c = 3 \times 10^8$ (m s^{-1}) used in $c = f\lambda$ [$\Rightarrow \lambda = 0.12$ m/12 cm/120 mm]	✓	
	(ii)	Measure SQ[34 mm], QP[34 mm] and SP[32 mm] and multiply readings by 5 [170 mm, 170 mm, 160 mm] [No tolerance on measurements, no ue]	✓	
		Add SQ and QP [ecf their values]	✓	
		Mention of path difference or attempt to find path difference e.g. (SQ+QP) − SP	✓	
		Conversion of any length to wavelengths	✓	
		Correct discussion of superposition/phase difference relevant to their path difference [Allow maximum if mention π phase shift on reflection]	✓	**6**
	(iii)	Mention of nodes/antinodes [not constructive/destructive interference]	✓	
		Energy at antinodes/no energy at nodes [Accept heating at antinodes]	✓	
		Rotate meat (plate)/reflect waves from (metal) paddle/move meat several times	✓	**3**
				16

4. (a) Push end of slinky in **suddenly**/**quickly** ✓

Time how long to reach end ✓

Measure length of slinky and use
υ = *defined length/defined time* ✓

Reliability: repeat **and** average/use very short pulse ✓

4

(b) (i) LHS: $m\ s^{-1}$

RHS: l is m and m is kg ✓

k is $N\ m^{-1}$ ✓

N is $kg\ m\ s^{-2}$ ✓

[k is $kg\ s^{-2}$ is last 2 marking points]

(ii) k is double (that of a spring) ✓ **4**

(c)	(i)	Rearrangement of $B = \mu_0 nI \Rightarrow n = B/\mu_0 I$	✓	
		$\therefore n = (0.34\times10^{-3}\ \text{N A}^{-1}\ \text{m}^{-1}) \div (4\pi \times10^{-7}\ \text{N A}^{-2})(5\ \text{A})$	✓	
		$= 54\ \text{m}^{-1}$	✓	**3**
	(ii)	Mention of magnetic flux/flux/ϕ [Do not accept magnetic flux density]	✓	
		Increasing/changing ϕ (as pulse reaches coil) [Accept decreasing]	✓	
		Because ϕ or B depends on n [can be symbols or words]	✓	
		Reference to Faraday/rate of change of ϕ or B	✓	**Max 4**
		Producing induced e.m.f./voltage in coil [**not** current]	✓	**15**