DHS	Mark Scheme	Syllabus
	Year 6 Preliminary Examinations H1 Physics 2015	**8866**

Paper 1

Question Number	*Key*	*Question Number*	*Key*
1	**B**	16	**B**
2	**D**	17	**D**
3	**C**	18	**B**
4	**A**	19	**B**
5	**C**	20	**A**
6	**A**	21	**C**
7	**C**	22	**D**
8	**A**	23	**B**
9	**C**	24	**C**
10	**C**	25	**C**
11	**A**	26	**B**
12	**B**	27	**C**
13	**C**	28	**D**
14	**C**	29	**D**
15	**B**	30	**D**

Paper 2

1 **(a)** spacing = 0.38 nm — A1

(b) time = $\frac{24 \times 3600}{10^3}$ = 86.4 ks — A1

(c) time = $\frac{150 \times 10^9}{3 \times 10^8 \times 3600}$ — M1

= 0.139 hours — A1

(d) acceleration and momentum — A1

2 **(a)** (+ or -) g cos(8.2°) — A1 — [1]

(b) s = ut + ½ at^2 (apply to direction perpendicular to slope)

0 = 63sin(14°+8.2°) – ½ g cos(8.2°)t — C1

t = 4.9 s — A1 — [2]

(c) s = ut + ½ at^2 (apply to direction along slope)

= 63cos(14°+8.2°)t + ½ g sin(8.2°)t^2 — C1

= 302 m = 300 m — A1 — [2]

(d) Distance is the actual path travelled. — B1

Displacement is the straight line between A and B or minimum distance between A and B. — B1 — [2]

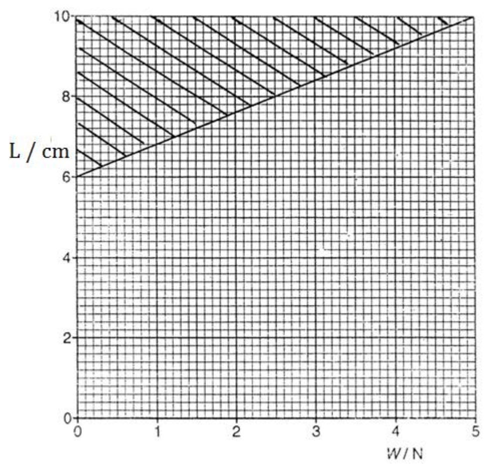
3 **(a)** Work done = average force x distance moved in direction of force — M1

= $\frac{1}{2}Fx$ (or area under $F - x$ graph which is $\frac{1}{2}Fx$)

Since $F = kx$ — A1

So Work or energy, $E = \frac{1}{2}(kx)x = \frac{1}{2}kx^2$ — [2]

(b)



(c) **(i)** 10.0 cm — A1

(ii) **1.** Change in GPE = $GPE_f - GPE_i$

= mg ($h_f - h_i$)

= 4.0 (-0.8 X 10^{-2}) — M1

= - 0.032

Magnitude of change = 0.032 J — A1

2. Change in EPE = $EPE_f - EPE_i$

$$= \frac{1}{2}kx_f^2 - \frac{1}{2}kx_i^2$$

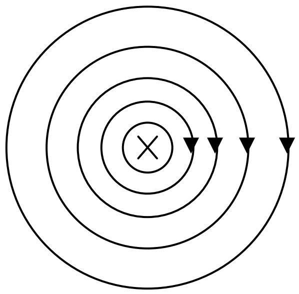
$$= \frac{1}{2}k\left(x_f^2 - x_i^2\right)$$

$$= \frac{1}{2}\left(\frac{5.00}{4.0\times10^{-2}}\right)(0.040^2 - 0.032^2)$$ M1

= 0.036 J A1 [5]

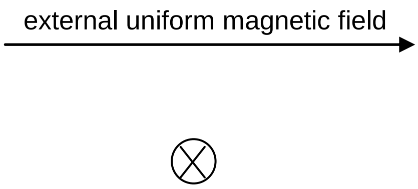
(d) Remove the load and check if spring returns to its original length. A1 [1]

4 (a)



Circular shape and correct direction-- B1
Correct spacing – B1

(b)



P

Correct position -- A1

(c) (i) $B_{wire} = B_{horizontal}$ M1

$\Rightarrow \frac{\mu_O I}{2\pi r} = 2.0\text{x}10^{-5}$

$\Rightarrow I = \frac{(2.0\times10^{-5})(2\pi\times0.15)}{4\pi\times10^{-7}}$ M1

= 15 A A1

(ii) From $F = B\,I\,L$,

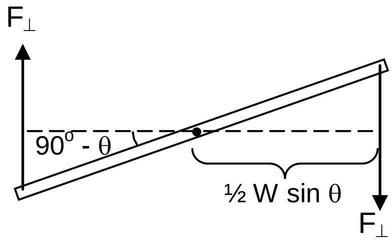
$\Rightarrow F / L = B\,I$ M1

$= (2.0\text{x}10^{-5})\ (15)$

$= 30\text{x}10^{-5}\ \text{Nm}^{-1}$ A1

(d) (i) When the plane of the coil is parallel to the magnetic field, there is no force acting on the top and bottom sides of the coil. However, the forces acting on the left and right sides of the coil have the same magnitude but are acting in opposite directions. Hence, the resultant force acting on the coil is zero. A1

(ii) The resultant torque acting on the coil is due to forces acting the on left and right sides of the coil. Forces acting on the top and bottom sides of coil will only serve to expand or compress the coil.



$\therefore \quad \tau$ = $F_\perp$ x (½ W sin θ) + $F_\perp$ x (½ W sin θ)

= $F_\perp$ x (W sin θ) , where $F_\perp$ = N B I L sin 90^o

= N B I L W sin 30^o (or N B I A sin θ, where A = L x W)

= (25) (55 x 10^{-3}) (2.0) (30 x 10^{-3}) (10 x 10^{-3}) (sin 30^o) M1

= 4.13 x 10^{-4} Nm A1

Note:

- The B-field is always perpendicular to the left and right sides of the coil ,but the top and bottom sides will have varying angle θ.
- Some students did not read the question or diagram carefully, and took the angle θ as that made between the B-field and the surface of the coil (ie use θ = 60^o).

5 **(a)** Energy at infinity = 0 (energy increases at higher level) B1

Work done on electron to bring it to higher level/
work got out as electron move to lower level B1 [2]

(b) **(i)**

$hf = |E_1 - E_2|$

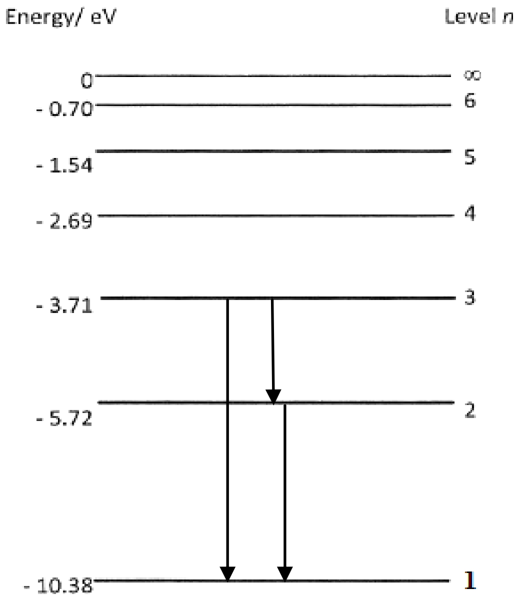
$= |-10.38 - (-5.72)| = 4.66eV$ A1

$f = \dfrac{4.66 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}} = 1.12 \times 10^{15}\text{Hz}$

(ii) No, photons would not be emitted. A1

Energy of incident photon not equal
to energy difference between ground and any higher level. M1 [3]

(iii)



B1

(c) $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mE}}$

$= \frac{6.63\times10^{-34}}{\sqrt{2\times9.11\times10^{-31}\times7.60\times1.6\times10^{-19}}}$ C1

$= 4.5 \times 10^{-10}$ m A1 [2]

6 **(a)** **(i)** 350/9.81 = 35.7 kg A1

(ii) girl took 0.50 s to fall M1

$v = gt = (9.81 \times 0.50) = 4.9$ m s^{-1} A1

(iii) $h = \frac{1}{2} gt^2$

$= \frac{1}{2}(9.81)(0.50)^2$ C1

= 1.2 m A1

(iv) maximum force on girl = 1400 N

Acceleration = 1400/35.7 = 39.2 m s^{-2} A1 [6]

(b) **(i)** Net force is still in downward direction M1

Girl continues to accelerate downwards A1

(ii) Change in momentum = area under the graph from C to D M1

= ½ (350)(0.53 – 0.50)

= 5.3 N s (approx.) A1

(iii) $35.7 (v_{max} – 4.9) = 5.3$ C1

$V_{max} = 5.0$ m s^{-1} A1 [6]

(c) constant force, *F* = *ma*

uniform acceleration, apply kinematics equation $0^2 = v^2 + 2as$

displacement $s = -v^2/(2a)$ M1

Work – energy theorem, change in Kinetic Energy = Work done on car.

			$KE_{final} - KE_{initial} = Fs$	M1	
			$-KE_{initial} = (ma)\left(-\frac{v^2}{2a}\right)$		
			$KE_{initial} = \frac{1}{2}mv^2$	A0	[2]
	(d)		Power = $F_{driving}v$		
			Constant speed so $F_{resistive} = F_{driving}$ = 1800/12 = 150 N	A1	[1]
	(e)		$F_{driving} - F_{resistive} = ma$		
			$F_{driving}$ = (850)(2.50) + 150	C1	
			= 2275 = 2280 N	A1	[2]
	(f)	**(i)**	R proportional to v^2		
			$\frac{R}{150} = \frac{36^2}{12^2}$	C1	
			R = 1350 N	A1	
		(ii)	Power = (1350)(36) = 48600 W	A1	[3]
7	**(a)**	**(i)**	amplitude = 1.5 mm	A1	
		(ii)	wavelength = 8.0 cm	A1	
		(iii)	distance travelled in 0.20 s is 3.2 cm	C1	
			Speed = 0.032 / 0.20 = 0.16 m s^{-1}	A1	[4]
	(b)	**(i)**	Pulse of similar shape and inverted.	B1	
		(ii)	The string exerts an upward force on the wall, and	M1	
			the wall exerts a downward force on the string by N3L,	M1	
			creating an inverted pulse.	A0	[3]
	(c)		Any two:	B2	[2]
			No energy transfer for standing wave/ progressive waves transfer energy		
			Amplitude varies along its length for standing wave / progressive wave has a constant amplitude		
			Neighbouring points (in inter-nodal loop) vibrate in phase for standing wave		
	(d)	**(i)**	Waves reflected at fixed end at wall	B1	
			Two waves travelling in opposite directions overlap / meet with same frequency, resultant displacement is the sum of displacements of each wave	B1	
			Produces nodes and antinodes (formation of standing wave)		
		(ii)	¾ λ = 3.0 ➔ λ = 4.0 cm	C1	
			Speed = fλ = (360) (0.040) = 14 m s^{-1}	A1	[4]
	(e)	**(i)**	x =λD/a		
			= (650 x 10^{-9}) (1.2) / (1.1 x 10^{-3})	M1	
			= 0.71 mm	A1	
		(ii)1	Same separation	B1	
			Bright areas brighter but dark areas no change	B1	
			Fewer fringes observed	B1	
		2	Same separation	B1	
			Same (slight decrease) brightness for fringes	B1	[7]
			(note: locations of the bright fringes will change, depend on the phase difference between the waves coming from both slits)		

8 **(a)** resistance = $(\frac{2}{R} + \frac{2}{R})^{-1}$ M1

$= \frac{R}{4}$ A1

(b) **(i)** resistance = $\frac{4.0}{0.20}$ = 20 Ω A1

(ii) potential difference = $\frac{15}{15+60}$ x 8.0 M1

= 1.6 V A1

(iii) current = $\frac{1.6}{20}$ = 0.080 A A1

(iv) power of lamp = 0.080 x 1.6 = 0.128 W M1
Since operating power of lamp is very much less than its normal M1
operating power, the lamp may not light up or dimly lighted up. A1

(c) Resistance to movement of charge (current) within an electrical power source. B1
causing energy loss in the source. B1

(d) **(i)** When current flows through a battery, the p.d. across the battery (known as terminal pd) is smaller then its e.m.f by the pd across the internal resistance.
In X, there is no current flowing since the voltmeter has infinite resistance.
Hence the battery reads the emf of the battery. B1
In Y, there is a current flowing, hence the voltmeter reads the terminal pd. B1

(ii) For circuit Y, E = V + Ir
4.5 = 3.1 + 0.39 r M1
r = 3.6 Ω M1

hence, internal resistance for each cell = 3.6/3 = 1.2 Ω A1

(iii) 1. Reading on voltmeter in **X =** 1.5 V A1

2. Resistance in circuit **Y =** 8.0 + 3.6 = 11.6 Ω M1
Hence new current = (8.0/11.6)(1.5) = 1.03 V A1

(iv) thermistor A1