edexcel
advancing learning, changing lives

Mark Scheme (Results)
January 2007

GCE

GCE Salters Horners Physics (6754/01)

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Mark scheme notes

Underlying principle

The mark scheme will clearly indicate the concept that is being rewarded, backed up by examples. It is not a set of model answers.

For example:

(iii) Horizontal force of hinge on table top

66.3 (N) or 66 (N) **and** correct indication of direction [no ue] [Some examples of direction: acting from right (to left) / to the left / West / opposite direction to horizontal. May show direction by arrow. Do not accept a minus sign in front of number as direction.]	✓	**1**

This has a clear statement of the principle for awarding the mark, supported by some examples illustrating acceptable boundaries.

1. Mark scheme format

1.1 You will not see 'wtte' (words to that effect). Alternative correct wording should be credited in every answer unless the ms has specified specific words that must be present. Such words will be indicated by underlining e.g. 'resonance'

1.2 Bold lower case will be used for emphasis.

1.3 Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".

1.4 Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

2. Unit error penalties

2.1 A separate mark is not usually given for a unit but a missing or incorrect unit will normally cause the final calculation mark to be lost.

2.2 Incorrect use of case e.g. 'Watt' or 'w' will **not** be penalised.

2.3 There will be no unit penalty applied in 'show that' questions or in any other question where the units to be used have been given.

2.4 The same missing or incorrect unit will not be penalised more than once within one question but may be penalised again in another question.

2.5 Occasionally, it may be decided not to penalise a missing or incorrect unit e.g. the candidate may be calculating the gradient of a graph, resulting in a unit that is not one that should be known and is complex.

2.6 The mark scheme will indicate if no unit error penalty is to be applied by means of [no ue].

3. Significant figures

3.1 Use of an inappropriate number of significant figures in the theory papers will normally only be penalised in 'show that' questions where use of too few significant figures has resulted in the candidate not demonstrating the validity of the given answer.

3.2 Use of an inappropriate number of significant figures will normally be penalised in the practical examinations or coursework.

3.3 Using $g = 10\ m\ s^{-2}$ will **not** be penalised.

4. Calculations

4.1 Bald (i.e. no working shown) correct answers score full marks unless in a 'show that' question.

4.2 If a 'show that' question is worth 2 marks then both marks will be available for a reverse working; if it is worth 3 marks then only 2 will be available.

4.3 **use** of the formula means that the candidate demonstrates substitution of physically correct values, although there may be conversion errors e.g. power of 10 error.

4.4 **recall** of the correct formula will be awarded when the formula is seen or implied by substitution.

4.5 The mark scheme will show a correctly worked answer for illustration only.

4.6 Example of mark scheme for a calculation:

'Show that' calculation of weight

Use of L × W × H ✓

Substitution into density equation with a volume and density ✓

Correct answer [49.4 (N)] to at least 3 sig fig. [No ue] ✓
[Allow 50.4(N) for answer if 10 N/kg used for g.]
[If 5040 g rounded to 5000 g or 5 kg, do not give 3rd mark; if conversion to kg is omitted and then answer fudged, do not give 3rd mark] **3**
[Bald answer scores 0, reverse calculation 2/3]

Example of answer:

$80 \text{ cm} \times 50 \text{ cm} \times 1.8 \text{ cm} = 7200 \text{ cm}^3$

$7200 \text{ cm}^3 \times 0.70 \text{ g cm}^{-3} = 5040 \text{ g}$

$5040 \times 10^{-3} \text{ kg} \times 9.81 \text{ N/kg}$

$= 49.4 \text{ N}$

5. Quality of Written Communication

5.1 Indicated by QoWC in mark scheme, placed as first mark.

5.2 Usually it is part of a max mark.

5.3 In SHAP marks for this are allocated in coursework only but this does not negate the need for candidates to express themselves clearly, using appropriate physics terms. Likewise in the Edexcel A papers.

6. Graphs

6.1 A mark given for axes requires both axes to be labelled with quantities and units, and drawn the correct way round.

6.2 Sometimes a separate mark will be given for units or for each axis if the units are complex. This will be indicated on the mark scheme.

6.3 A mark given for choosing a scale requires that the chosen scale allows all points to be plotted, spreads plotted points over more than half of each axis and is not an awkward scale e.g. multiples of 3, 7 etc.

6.4 Points should be plotted to within 1 mm.

- Check the two points furthest from the best line. If both OK award mark.
- If either is 2 mm out do not award mark.
- If both are 1 mm out do not award mark.
- If either is 1 mm out then check another two and award mark if both of these OK, otherwise no mark.

6.5 For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

6754 Unit Test PSA4

1.

(a)(i) Recall of $Q = CV$ **or** $W = 1/2\ CV^2$ ✓
Correct calculation of W **or** V **or** C ✓
$\Rightarrow$ Conclusion [must be consistent] ✓

eg $W = 1/2\ CV^2$
$\Rightarrow C = 2\ W/V^2 = 2 \times 0.045 / (30{,}000)^2$ (F)
$= 1 \times 10^{-10}$ (F) = 100 (pF) ($\Rightarrow$ NOT COMPATIBLE)
or $\Rightarrow W = 1/2 \times 10 \times 10^{-12} \times (30{,}000)^2$ (J)
$= 0.0045$ (J) ($\Rightarrow$ NOT COMPATIBLE) **3**
[no mark for conclusion; but ue for saying 100pF ~ 10 pF]

(ii) Sub of one appropriate value into $Q = CV$ **or** $W = 1/2QV$ ✓
Correct value ✓

eg Charge $= 1 \times 10^{-10} \times 30{,}000$ (C)
$= 3 \times 10^{-6}$ C **2**

(b)(i) Use of $E = V/d$ [Rearranged or subbed into] ✓
Correct value ✓

eg $d = V/E = 30{,}000/3 \times 10^6$ (m)
= 0.01 m **2**

(ii) Use of $E = F/q$ [Rearranged or subbed into - any charge value] ✓
Correct value ✓

eg $F = Eq = 3 \times 10^6 \times 1.6 \times 10^{-19}$ (N)
$= 4.8 \times 10^{-13}$ N **2**

(e) Correct use of 1 mm in $W = Fd$ **or** $V = Ed$ [ecf from(b)(ii)] ✓
$\Rightarrow$ 3000 (V or eV)) ✓
$\Rightarrow$ correct value ✓

eg $W = Fd = 4.8 \times 10^{-13}$ N $\times$ 0.001 m ($= 4.8 \times 10^{-16}$ J)
$\Rightarrow$ 3000 (eV)
3000/35 = 85/86/85.7
or $V = Ed$ = (3×10^6 V/m) $\times$ 0.001 (m)
$\Rightarrow$3000 (V)
3000/35 = 85/86/85.7 **3**

12

2.

(a) Any 2 from:

momentum conserved	✓	
initial momentum zero	✓	**(Any 2)**
⇒ final momentum zero	✓	
[opposite charges repel => xx]		**2**

(b)

0.140 GeV/c^2	✓	
-1.6×10^{-19} C	✓	
anti-u, d	✓	**3**

(c)

Meson	✓	**1**

(d)

[✓ for 0.14 (alone) **or** correct use of 10^9]	✓	
Minimum energy = 1.4×10^8 (eV) **or** 0.14×10^9 (eV)	✓	**2**
[0.14 G is ✓x]		

(e)

Particles have <u>K.E.</u> (as well as mass)	✓	**1**

(f)

Use of $\Delta E = c^2 \Delta m$ [rearrangement OR one correct line subbed)	✓	
correct value	✓	
eg $\Delta m = \Delta E / c^2 = 0.14 \times 10^9 \times 1.6 \times 10^{-19}$ J / $(3 \times 10^8 \text{ ms}^{-1})^2$		
Mass loss = 2.5×10^{-28} kg		**2**
[ecf from (d)]		

11

3.

(a)	R drawn [10^o to vertical]	✓	
	D drawn [10^o to horizontal]	✓	
	drag force D = 140 – 155 N [147.6 N by calc is OK]	✓	**3**
(b)	Resolve vertically	✓	
	correct value	✓	
	eg $P \cos 40^o = 850$ N		
	$\Rightarrow P = 1100$ N		**2**
(c)(i)	velocity not constant / direction changing	✓	
	[NOT "if no force, goes straight"]		
	acceleration (towards centre of circle)	✓	**(Any 2)**
	$F = ma$	✓	**2**
(ii)	P/push of ice (on sled)	✓	
	horizontal component	✓	**2**
	["additional centripetal force" = 0]		
(d)	Recall circular motion formula	✓	
	resolve horizontally	✓	
	correct value	✓	
	[incorrect force is eop]		
	[also possible: W.tan40 = mv^2/r ✓✓]		
	eg $F = P \sin 40 = 713$ (643) (N) [formula or value]		
	$R = mv^2/F$		
	$= 87 \times 35^2 / 713$ (643) (m)		
	radius = 149 (166) m		**3**
			12

4.

(a)	emf/voltage	✓	
	induced / created / caused by flux change	✓	**2**
(b)	Lenz	✓	
	effect opposes change producing it	✓	**2**
(c)	dynamo generates emf	✓1	
	lights off <=> no current	✓2	
	lights on <=> current flowing	✓3	**(Any 4)**
	If current, then force on dynamo rotor/$F = BIl$	✓4	
	[**or** field acting against field in dynamo]		
	This force opposes rotation	✓5	**4**

8

5.

(a)	Shape [lines not crossing]	✓	
	arrow(s)	✓	**2**
(b)	[reference to] changing B field/ flux cuts coil / changing flux (linkage)	✓1	
	induces emf **or** current [NOT "output"] /EM induction	✓2	
	emf α rate of change / Faraday's law stated	✓3	
	output is gradient of flux graph	✓4	
	signal +ve while ϕ increases / -ve while ϕ decreases	✓5	
	max emf for max $d\phi$ / dt / steepest gradient	✓6	**(Any 5)**
	Emf 0 when gradient = 0	✓7	
	[✓5 ✓6 ✓7 can be gained by annotations on graph]		**5**
(c)	(Binary / 1 or 0 / 2^{10}		
	maximum number =) 1024	✓	**1**
(d)	10010	✓	**1**
(e)	Attempt to calculate circumference (formula or numbers)	✓	
	dividing by 0.83×10^{-6} (m)	✓	
	correct value	✓	
	eg $C = \pi d = \pi \times 0.089$ m (= 0.2796 m)		
	No of bits along circumference = $C \div (0.83 \times 10^{-6}$ m) ($= 3.37 \times 10^5$)		**3**
	Rate = $3.37 \times 10^5 \times 120$ (7200 revs/min = 120 Hz)		
	$= 4.04 \times 10^7$ s^{-1}		
	[2.43×10^9 min^{-1} is OK]		**12**

6.	Correct use of $I = I_0 e^{-\mu x}$	✓	
	Values read into table [0,27; 50,19; 100,15; 150,10; 200,8]	✓	
	ln$I$ [OR ln(I/I_0)] values calculated / used [3.30; 2.94; 2.70; 2.30; 2.08]	✓	
	Graph of ln plotted	✓	
	Value: gradient $\mu = 6.1$ [range 5.6 - 6.6] m^{-1}	✓	**5**
	Alternative method: halving depth	✓✓✓ **(1 value)**	
	$\mu = \ln 2 / d_{1/2\ ½}$	✓✓✓✓ **(> 1 value)**	