

Edexcel GCE

Physics Unit no. 6735/01

January 2007

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**Confidential Mark Scheme** 

# Edexcel GCE Physics 6735/01



# 6735/01 (PHY5)

STRICTLY CONFIDENTIAL Please bring this mark scheme to the meeting

## General Certificate of Education Examination

## MARK SCHEME - JANUARY 2007

## ADVANCED SUBSIDIARY PHYSICS UNIT PHY5

## PRINCIPAL EXAMINER

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Detailed instructions to Examiners are contained in document E38/39. Please read it carefully.

Within the scheme:

/ indicates alternative marking point
( ) brackets indicate words not essential to the answer
[ ] brackets indicate additional guidance for markers
a.e. arithmetic error (-1 mark)

e.o.p. error of physics e.c.f. error carried forward s.f. sig figs (-1 mark where specified) u.e. unit error (-1 mark)

#### Quality of Written Communication

Read the answer through. Award the mark if you answer yes to ALL the following. The mark is *independent* of the marks for correct physics.

- Is the answer in the physics context of the question?
- Is the candidate's meaning *clear* on first reading?
- Is appropriate use made of physics terms?
- Is there effective use of spelling, punctuation and grammar?

# 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] ✓ 1 [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.]

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  $g = 10 \text{ m s}^{-2}$  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  $L \times W \times H$ 

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 3<sup>rd</sup> mark; if conversion to kg is omitted and then answer fudged, do not give 3<sup>rd</sup> mark] [Bald answer scores 0, reverse calculation 2/3]

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Example of answer:

80 cm × 50 cm × 1.8 cm = 7200 cm<sup>3</sup> 7200 cm<sup>3</sup> × 0.70 g cm<sup>-3</sup> = 5040 g  $5040 \times 10^{-3}$  kg × 9.81 N/kg = 49.4 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.

1.	Determination of capacitance			
	Correct answer $5 \times 10^{-4}$ F	√ 1	~	
	Example of answer	I		
	C = $\frac{Q}{V} = \frac{6 \times 10^{-3} \text{ C}}{12 \text{ V}} = 5 \text{ x } 10^{-4} \text{ F}$			
	Feature of graph			
	Area enclosed by the graph and the Q axis/ area under graph	✓ 1		√
	Calculate energy stored			
	Attempt to determine area / use of e.g. $\frac{1}{2}QV$ or $\frac{1}{2}CV^2$	$\checkmark$	$\checkmark$	
	Correct answer $3.6 \times 10^{-2} \text{ J}$	$\checkmark$		$\checkmark$
	[ecf capacitance value from (i) if used in calculation]	2		
	Add line to graph			
	Steeper straight line. [unless original C value calculated to be greater than 2000 $\mu$ F]	√	V	
	Line stops at (6V, 12mC) [No ecf]	✓	$\checkmark$	
	[Mark all points on graph. Ignore working shown here]	2		
	Total 6 m	arks	4	2

2.	Calculation of man's weight		
	Use of Newton's equation. $\checkmark$	$\checkmark$	
	Correct answer 684 N ✓		$\checkmark$
	Example of answer:		
	6.67 x 10 <sup>-11</sup> N m <sup>2</sup> kg <sup>-2</sup> × $\frac{70 \text{ kg} \times 6 \times 10^{-24} \text{ kg}}{(6.4 \times 10^6 \text{ m})^2} = 684 \text{ N}$		
	[no marks for using m x 9.81]		
	Tangential speed at the equator		
	$L_{\rm res} = 2\pi r$		
	Use of $-t$	$\checkmark$	
	Correct answer 465 m s <sup>-1</sup> $\checkmark$		$\checkmark$
	Example of answer:		
	$v = \frac{2\pi \times 6.4 \times 10^6 \mathrm{m}}{3600 \times 24 \mathrm{s}} = 465 \mathrm{m  s^{-1}}$		
	$\frac{\text{Centripetal force}}{\text{Correct answer } (2.36 - 2.42) \text{ N}} \checkmark$		✓
	Example of answer:		
	$F = \frac{mv^2}{r} = \frac{70 \text{ kg} \times (470 \text{ m s}^{-1})^2}{6.4 \times 10^6 \text{ m}} = 2.42 \text{ N}$		
	Effect on man's weight measurement		
	<b>Measured</b> weight will be less [watch out for 'It' or 'his weight' is less,] / value correctly found.	~	
	E.g. Measured weight = $684 - 2.4 = 681.6$ N		
	Part of the gravitational force provides the required resultant force towards the centre of the Earth / centripetal force.	~	
	2		
	Total 7 marks	4	3

3.	One difference between E fields of point charge and parallel plates		
	E field of point charge is radial, for parallel plates it is uniform. $\checkmark$	✓	
	E field of point charge reduces with distance / is $\propto \frac{1}{r^2}$ , for		
	parallel plates the field strength is constant. $d^2$	~	
	[Both aspects of difference must be stated] MAX 1		
	Electric field strengths due to each charge		
	Use of $\frac{kQ}{r^2}$	~	
	Correct answer (–) $3.6 \times 10^6$ V m <sup>-1</sup>		$\checkmark$
	Correct answer $2 \times 10^7$ V m <sup>-1</sup>		$\checkmark$
	Example of answer:		
	$\frac{8.99 \times 10^9 \text{ N m}^2 \text{ C}^{-2} \times 2 \times (10^{-6}) \text{ C}}{\left[3 \times (10^{-2})\right]^2 \text{ m}^2} \text{ / same but using } 5 \times (10^{-2}) \text{ m}$		
	Directions of E fields at P due to both charges		
	Two arrows at P, one pointing upwards <b>AND</b> one pointing towards $-1 \mu C$	✓	
	[both arrows required for the single mark] $\checkmark$ 1		
	How to locate the positions of the 2 $\mu$ C		
	A straight line from $-1\mu$ C through P, intersecting the circle at two (diametric) points.		√
	Marking and labelling the points		
	Max and Min <u>both</u> correctly labelled $\checkmark$ 1		$\checkmark$
	Total 7 marks	3	4

4.	Direction of magnetic field		
	'Into' the end A ✓ 1	$\checkmark$	
	Why a momentary current is formed		
	QoWC 🗸		$\checkmark$
	Changing current in coil 1 changes field in coil 1 $\checkmark$		$\checkmark$
	Coil 2 experiences this changing B field (from coil 1)		$\checkmark$
	(Thus) Emf is induced across coil 2 $\checkmark$		$\checkmark$
	A current is produced in coil 2 since it is in a closed circuit. $\checkmark$		$\checkmark$
	Once current (in coil 1) is steady flux stops changing / no emf is induced / there is no 'induced' current.		$\checkmark$
	5 Max		
	Why its direction is Q to P		
	The direction of the current must produce a South pole at the end of the coil in circuit 2 that faces A / a similar polarity to end A . $\checkmark$		$\checkmark$
	Reference to Lenz's Law./ This will oppose the rise of flux / flux change in circuit 1.		$\checkmark$
	Total 8 marks	1	7

5.	$\frac{\text{Directions of B fields}}{B_{8A} \text{ is `into page' and } B_{2A} \text{ is `out of page' [not `up' or `down']}} \checkmark$	~	
	1		
	Resultant magnetic field		
	Substitute into $\frac{\mu_0 I}{2\pi a}$	~	
	E.g. $\frac{4\pi \times 10^{-7} \times 8 \text{ A}}{2\pi \times 0.015 \text{ m}}$ or same with 2A		
	[Check 'a' value correctly given as 0.015 m)]		
	<b>Both</b> $1.07 \times 10^{-4}$ T and $2.67 \times 10^{-5}$ T found	~	
	B values subtracted to give correct answer $8.0 \times 10^{-5} \mathrm{T}$ $\checkmark$		✓
	[Or B values added to give $13.4 \times 10^{-5}$ T, ecf part a,]		
	3		
	What happens when the switch is closed		
	Current is down the page $\checkmark$	~	
	(Resultant) magnetic field is <u>into</u> the page (ecf judgement on 8A field direction in part a) $\checkmark$	~	
	'Fleming's Left Hand Rule' ✓	~	
	Foil moves to the right (Or 'left', ecf their 8A field direction) $\checkmark$	~	
	3 Max		
	Total 7 marks	6	1

6.	Why filament is supplied with thermal energy		
	(Energy is needed / work must be done) to liberate electrons from the metal structure/metal atoms. / Work function idea.		$\checkmark$
	[Not 'to overcome electrostatic attraction']		
	Calculation		
	See substitution of correct values of $e = 1.6 \times 10^{-19} \text{ C}$ and $\Delta V = 5000 \text{ V}$ in $e \Delta V$ expression for electrical work done	~	
	See substitution of $m_e = 9.11 \times 10^{-31} \text{ kg into } \frac{1}{2}m_e v^2$ $\checkmark$	~	
	Correct answer 4.2 x $10^7$ m s <sup>-1</sup>		$\checkmark$
	3		
	Why electrons do not have identical speeds		
	The electrons are emitted with a range of speeds/range of kinetic energies from the filament. / Electrons are emitted in different directions from the filament. / Electrons within the electron beam		
	interact (to cause acceleration or deceleration)		$\checkmark$
	1		
	Total 5 marks	2	3
	Paper Total 40	20	20