GCE

Edexcel GCE

Physics (6734/01)

Summer 2005

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Mark Scheme (Results)

Edexcel GCE
Physics (6734/01)

Contents

Notes on the Mark Schemes

1. *Alternative responses:* There was often more than one correct response to a particular question and these published mark schemes do not give *all* possible alternatives. They generally show only the schemes for the most common responses given by candidates. They are **not** model answers but indicate what the Examiners accepted in this examination.

2. *Error carried forward:* In general, an error made in an early part of a question is penalised there but not subsequently, i.e. candidates are penalised once only, and can gain credit in later parts of a question by correct reasoning from an earlier incorrect answer.

3. *Quantity algebra:* The working for calculations is presented using quantity algebra in the mark schemes for Units PHY1, PHY2, PHY3 (Topics), PHY4, PHY5/01, and PHY6 but candidates are not required to do this in their answers.

4. *Significant figures:* Use of an inappropriate number of significant figures in the theory papers will normally be penalised only in "show that" questions where too few significant figures has resulted in the candidate not demonstrating the validity of the given answer. Use of an inappropriate number of significant figures will normally be penalised in the practical tests. In general candidates should nevertheless be guided by the numbers of significant figures in the data provided in the question.

5. *Unit penalties:* A wrong or missing unit in the answer to a calculation will generally lose one mark unless otherwise indicated.

6. *Quality of written communication:* Each theory paper will usually have 1 or 2 marks for the quality of written communication. The mark will sometimes be a separate mark and sometimes be an option in a list of marking points.

Within the schemes:

- / indicates alternative marking point
  ( ) brackets indicate words not essential to the answer
  [ ] brackets indicate additional guidance for markers

- The following standard abbreviations are used:

a.e.	arithmetic error (–1 mark)
e.c.f.	error carried forward (allow mark(s))
s.f.	significant figures (–1 mark only where specified)
no u.e.	no unit error

6734 Unit Test PHY4

1.(a) Resultant force required

The direction of speed OR velocity is changing ✓

There is an acceleration/rate of change in momentum ✓ **2**

(b)(i) Angular speed

Use of an angle divided by a time ✓

7.3×10^{-5} rad s^{-1} OR 0.26 rad h^{-1} OR 4.2×10^{-3} ^{o} s^{-1} OR 15^{o} h^{-1} ✓ **2**

(ii) Resultant force on student

Use of $F = mr\omega^2$ OR $v = r\omega$ with $F = \frac{mv^2}{r}$ ✓

2.0 N ✓ **2**

(iii) Scale reading

Evidence of contact force = mg – resultant force ✓

Weight of girl = 588 (N) OR 589 (N) OR 60 × 9.81 (N) ✓

Scale reading = 586 N OR 587 N [ecf their mg − their F] ✓ **3**

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2. Table

Wavelength of light	in range 390 nm – 700 nm	✓	
Wavelength of gamma	$\leq 10^{-11}$ m	✓	
Source	(unstable) nuclei	✓	
Type of radiation	radio (waves)	✓	
Type of radiation	infra red	✓	
Source	Warm objects / hot objects / above 0 K	✓	**6**

3.(a) Calculation of intensity

6.0% of 100 (W) is 6 (W) ✓

Use of $I = P/4\pi r^2$ ✓

Intensity = 7.6×10^{-2} W m^{-2} ✓ **3**

Average photon energy

(b) Average energy = $\dfrac{7.6 \times 10^{-2}\,(W\,m^{-2})}{2.4 \times 10^{17}\,(m^{-2}\,s^{-1})}$ [ecf intensity] ✓

Correct use of 1.6×10^{-19} ✓

Average photon energy = 2.0 (eV) [full ecf for I = 1.27 W ie P=100 W giving 33.3 (eV)] ✓ **3**

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4.(a)	Amplitude		
	Maximum distance/displacement		
	From the mean position / mid point / zero displacement line / equilibrium point [If shown on a diagram, at least one full wavelength must be shown, the displacement must be labelled "a" or "amplitude" and the zero displacement line must be labelled with one of the terms above.]	✓	**1**
(b)	<u>Progressive wave</u>		
	Displacement at A: 2.0 (cm) [accept 2]	✓	
	Displacement at B: 2.5 (cm) to 2.7 (cm)	✓	
	Displacement at C: 1.5 to 1.7 (cm)	✓	**3**
	<u>Diagram</u>		
	[Minimum] one complete sinusoidal wavelength drawn	✓	
	Peak between A and B [accept on B but not on A]	✓	
	$y = 0$ (cm) at $x = +2.6$ cm with EITHER $x = +6.2$ cm OR $x = -1.0$ cm	✓	**3**
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5.(a) Transverse wave

(Line along which) particles/em field vectors oscillate/vibrate ✓

Perpendicular to ✓

Direction of travel or of propagation or of energy flow or velocity ✓ **3**

(b) Differences

Any two:

Standing waves	Progressive waves		
1. store energy	1. transfer energy	✓	
2. only AN points have max ampl/displ	2. all have the max ampl/displ	✓	
3. constant (relative) phase relationship	3. variable (relative) phase relationship	✓	**Max 2**

(c)(i) Droplets

Formed at nodes / no net displacement at these points ✓ **1**

(ii) Speed

Use of $\upsilon = f\lambda$ ✓

Evidence that wavelength is twice node-node distance ✓

Wavelength = 1.2 (cm) ✓

Frequency = 8.0 [8.2 / 8.16] Hz or s^{-1} only ✓ **4**

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6.(a)(i) Diagram

Component ($mg\cos\theta$) correctly drawn – good alignment and approximately same length ✓ **1**

(ii) Diagram

Component ($mg\sin\theta$) correctly drawn, reasonably perpendicular to T to the left ✓ **1**

(iii) Acceleration

Use of $mg\sin\theta = ma$ [must see 9.8(1) (m s^{-2}) not 10 for this mark] ✓

a = 0.68 m s^{-2} [for this mark allow 0.69 m s^{-2} ie 10 m s^{-2} for g] ✓ **2**

(iv) Direction

Directed to O along arc/in same direction as $mg\sin\theta$/tangential to arc ✓ **1**

(b) Acceleration of free fall

See $T^2 = \dfrac{4\pi^2 l}{g}$ [or see numbers] ✓

Evidence of difference / $l_1 - l_2 = 1.0$ (m) ✓

Correct final rearrangement for g ✓ **3**

$$\left[g = \frac{4\pi^2 1.0\ (m)}{4.2^2\,(s^2) - 3.7^2\,(s^2)} \right]$$

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7.(a) Electromagnetic Doppler effect

Change in the frequency/wavelength (of the light/radiation from a source) ✓

because of relative motion between source and observer ✓ **2**
[If giving specific examples must cover both possibilities of change in frequency and relative motion eg describe red shift and blue shift]

(b) Hubble's conclusions

Any two from:

- (Recession) velocity $\propto$ galaxy distance [NOT stars]
- Red shift due to a galaxy moving away from Earth/observer
- Deduction of the expanding Universe [not the Big Bang] ✓✓ **2**

[only penalise lack of galaxy **once**]

(c) Minimum velocity

$\Delta\lambda = 660\ (\text{nm}) - 390\ (\text{nm}) = 270\ (\text{nm})$ ✓

Their $\Delta\lambda$ / their short $\lambda = v/c$ ✓

Correct substitution of $c = 3 \times 10^8\ (\text{m s}^{-1})$ ✓

Maximum velocity = $2.1 \times 10^8\ (\text{m s}^{-1})$ ✓ **4**

(d) Critical mean density

Density is large enough to prevent Universe expanding for ever ✓

but not too big to cause a collapse/contraction of the Universe ✓ **2**

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8. Photoelectric effect

(a) Explanation:

Particle theory: one photon (interacts with) one electron ✓

Wave theory allows energy to 'build up', i.e. time delay ✓ **2**

(b) Explanation:

Particle theory: f too low then not enough energy (is released by photon to knock out an electron) ✓

Wave theory: Any frequency beam will produce enough energy (to release an electron, i.e. should emit whatever the frequency) ✓ **2**

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