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GENERAL CERTIFICATE OF EDUCATION
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MARKING SCHEME

PHYSICS (NEW)
AS/Advanced

JANUARY 2009

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2009 examination in GCE PHYSICS (NEW). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Notes on the interpretation of these marking schemes

The marking schemes, whilst reasonably complete do not give **all** the answers which were credited by the examiners. It is hoped that the schemes are self-explanatory, though they will need to be read alongside the question papers. The following clarifications may be of use:

Statements in brackets [ ] are exemplification, alternatives **or** statements which, whilst desirable in an answer were not required on this occasion for full marks. [accept .] indicates that, whilst not a good answer, it was accepted on this occasion.

The numbers in parentheses ( ) are the marks, usually 1, for each response.

e.c.f. stands for *error carried forward,* and indicates that the results of a previous (incorrect) calculation will be treated as correct for the current section. i.e. the mistake will only be penalised once. As a general rule, the principle of error carried forward is generally applied, even when not explicitly stated. It may also be applied *within* a calculation where a mistake is deemed to be an arithmetic slip and not an error of principle.

The expression [or by impl.] indicates that the mark is credited when subsequent credit-worthy working or answer demonstrates that this idea/equation has been used.

In general the physics of the answer needs to be correct but specific expressions or methods are often not required. The expression [or equiv.] emphasises that the particular idea, could be expressed in several different ways.

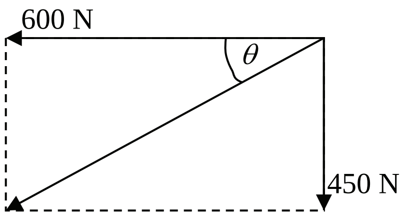
Incorrect or absent units are not always penalised; units are present in the mark scheme for completeness. Where ((**unit**)) appears it indicates that the unit is required for the mark to be awarded but attracts no separate mark. A (1) following the unit, in addition to a (1) following the numerical part of the answer, indicates that the unit itself attracts a mark.

Example: 25 GPa (1) ((**unit**)) indicates that the unit (or correct alternative. e.g. $2{\cdot}5 \times 10^{10}$ N m^{-2}) is a requirement for the mark;

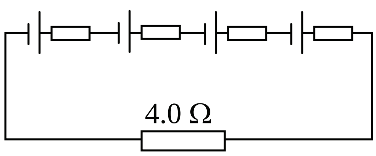
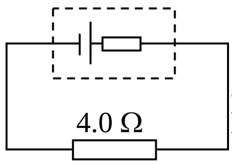
25 (1) GPa (1) indicates that the numerical part of the answer [$2{\cdot}5 \times 10^{10}$] and the unit Pa each attract a mark. In this case, an answer of 25 GN would be awarded the first mark but not the second, it being considered that the SI multiplier is numerical.

Unless otherwise stated, no penalties for excessive significant figures are applied in these papers. Significant figures are usually assessed only in the practical units.
N.B. This Mark Scheme is not a set of Model Answers.

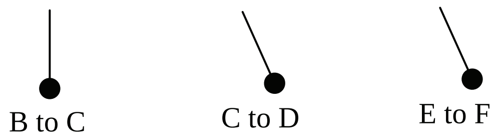
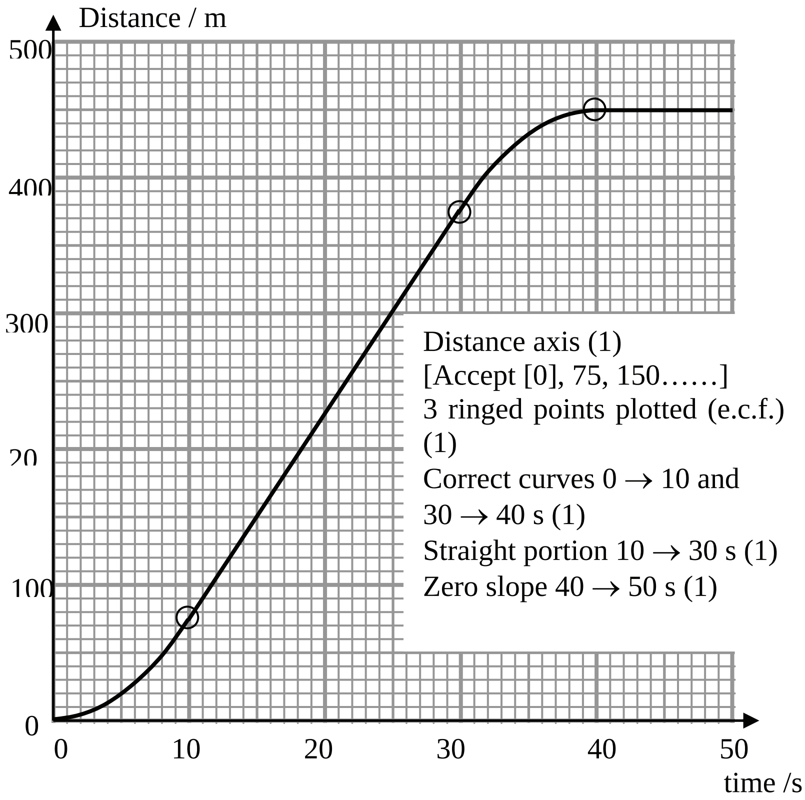
PH1 Mark Scheme – January 2009

Question			Marking details	Marks Available
1	*(a)*		ΣF = resultant force (1) a = acceleration (1) [– 1 mark if *mass* is given] [“Force = mass × acceleration” only →0]	2
	(b)	(i)	Attempt at Pythagoras (1) [**or** reasonable scale diagram] $F_R = \sqrt{600^2 + 450^2}$ $= 750\text{ N}$ (1) $\theta = \left[\tan^{-1}\frac{450}{600} = \right] 36.9^\circ$ (1) [angle clearly identified]  	3
		(ii)	$a = \frac{\sum F}{m}\left(= \frac{750\text{e.c.f.}}{5}\right)$ (1) $= 150\text{ m s}^{-2}$ (1) ((**unit**))[ans.]	2
				[7]
2.	*(a)*	(i)	Electrons transferred from [polythene] rod to [metal cap] [or equiv] [**Not** just –ve charge]	1
		(ii)	+ve (1) because electrons [accept: negative charges] transferred from duster to rod (1).	2
	(b)	(i)	Number of charged particles $= \frac{64 \times 10^{-9}}{1.6 \times 10^{-19}\text{(1)}} = 4 \times 10^{11}$ (1) [Division by e ✓, answer ✓]	2
		(ii)	$I = \frac{Q}{t}$ **or** rearranged **or** $\frac{64 \times 10^{-9}}{2 \times 10^{-6}}$ (1) [or by impl.] t = 32 ms (1)	2
				[7]

Question			Marking details	Marks Available
3	*(a)*		$V \propto I$ [or equiv. or in words] (1) provided that temperature remains constant (1)	2
	(b)	(i)	Parallel sect: $\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}$ **or** $\frac{1}{80}+\frac{1}{80}$ **or** $R=\frac{R_1R_2}{R_1+R_2}$ **or** $\frac{80\times 80}{80+80}$ (1) [or equiv or by impl.] R_{parallel} = 40 Ω (1) Total circuit resistance = 240 Ω (1) [no e.c.f.]	3
		(ii)	I. $I=\frac{V}{R}$ **or** $\frac{9}{240\text{e.c.f.}}$ (1) = 37.5 mA (1) [Or potential divider approach with 7.5 V and 200 Ω]	2
			II. 18.75 mA e.c.f.	1
		(iii)	Use of $P = I^2R$ or $\frac{V^2}{R}$ or IV (1) P dissipated in **A** = $\left(37.5\times 10^{-3}\right)^2 \times 200 = 0.28$ W (1) e.c.f. P dissipated in **C** = $\left(18.75\times 10^{-3}\right)^2 \times 80 = 0.028$ W (1) e.c.f. P_A:P_C = 10:1 ∴ A appears brighter. (1) [e.c.f. on a power attempt] [Bulb B instead of bulb A used −1]	4 **[12]**
4.	*(a)*		Resistance of wire = 40 Ω	1
	(b)		Temperature remains constant [**or** temperature change is (too) small (to affect resistance noticeably)] (1) Constant gradient → constant resistance [both parts needed] (1) [Accept: Voltage ∝ current <u>and</u> Ohm's Law obeyed] [Accept other well argued answer, e.g. wire could be constantan, which has negligible temperature variation of resistance, so graph doesn't tell us much.]	2
	(c)		$\rho=\frac{RA}{l}$ [or by impl.](1) [i.e rearrangement of $R=\frac{\rho l}{A}$] $\rho=\frac{40\text{e.c.f.}\times\pi\left(1.0\times 10^{-4}\right)^2}{2.5}$ [Correct expression for area →(1)] $\rho = 5.0 \times 10^{-7}$ Ω m(1) ((**unit**))	3
	(d)		**Graph**: Straight line graph through origin with lower gradient than original (1). With correct gradient [i.e. $^1/_3$ original] (1)	2 **[8]**

Question			Marking details	Marks Available
5	*(a)*		$E_P = mg\Delta h$ **or** 0.60 × 9.81 × 80 (1) [or by impl.] = 470 J (1) [Accept g = 9.8 m s^{-2} → 470 J; but g = 10 m s^{-2} → 1max]	2
	(b)		$E_k = \frac{1}{2}mv^2$ **or** $\frac{1}{2} \times 0.60 \times 30^2$ (1) [or by impl.] = 270 J (1)	2
	(c)	(i)	$\frac{470 = 270}{470}$ e.c.f. (=0.43)	1
		(ii)	Air molecules gain kinetic energy (1) Molecules of ball gain kinetic energy (1) [accept internal energy of ball increases]. [Accept "heat" instead of KE for one of the marks only]	2
	(d)		$W = Fx$ **or** rearranged **or** $\frac{470-270}{80}$ (or e.c.f.) (1) $\left[\text{Not } \frac{470}{80} \text{ or } \frac{270}{80}\right]$ [or by impl.] F = 2.5 N (1)	2 **[9]**
6	*(a)*		'per unit charge' [**or** 'per coulomb'] used correctly at least once. (1) V = energy delivered [per unit charge] to [external] circuit (1) E = energy supplied [per unit charge] from chemical energy of cell (1) Ir = energy wasted / lost / dissipated [per coulomb] in the internal resistance (1)	4
	(b)	(i)	 or  [with appropriate labelling] [or equivalent]	1
		(ii)	R_{Total} = 4.8 Ω [or by impl.] (1) I = 1.25 A (1) [Accept 1.3 A] no e.c.f.	2
		(iii)	P.d. across 4 Ω resistor = 5.0 V [e.c.f. 4.0 × *(b)*(i) ans]	1
	(c)		5.7V and R_{tot} = 5.0Ω (with) **or** 4.5V and R_{tot} = 4.6Ω (without cell)(1) *With run-down cell*: I = 1.14 A (1) *Without run-down cell*: I = 0.98 A (1) *Conclusion*: better not to remove (e.c.f.): strategy + conclusion (1)	4 **[12]**

Question			Marking details	Marks Available
7	*(a)*		Each m^3 (of sea water) has a mass of 1050 kg. [Reference to 'weight' – no mark]	1
	(b)	(i)	$P = \frac{1}{2} \times 1050 \times \pi(8)^2 \times (2.5)^2$ correct area term: $\pi(8)^2$ (1) [or by impl.] P = 1.65 MW (1) No e.c.f. on incorrect area.	2
		(ii)	Efficiency $= \frac{1000 \times 10^3}{1.65 \times 10^6} \times 100\%$ (=60.6%) [e.c.f. on P]	1
		(iii)	Not all of E_k [accept: energy] of water used by turbine / water retains some E_k after passing through turbine [Note: This reason predominates – responses involving wastage through E_k transfer to other forms not credited.]	1
		(iv)	I. Density of sea water >> density of air	1
			II. Out of sight (no visual impact) ✓ Regular / predictable energy generator ✓ Little environmental impact ✓ Fewer turbines so less materials/maintenance ✓ Less noise pollution ✓ } (any 1)	1
				[7]

Question			Marking details	Marks Available
7	*(a)*	(i)	<u>Constant</u> acceleration [or: steady; uniform]	1
		(ii)	 3 × (1)	3
		(iii)	Either D → E or F → G	1
		(iv)	No net force (acting on air freshener) [or equiv.]	1
	(b)		$x = \frac{u+v}{2}t$ **or** $t = \frac{2\times 75}{10}$ [or equiv.] (1) t = 15 s (1) On Graph: Straight line drawn from G to 85 s on t axis. (1)	3
	(c)	(i)	I. Area of Δ attempted (1) Distance = $\frac{1}{2}\times 10\times 15 = 75$ m (1) II. 75 m (e.c.f.) + (20 × 15) = 375 m III. 375 m (e.c.f. on time) + ($^1/_2$ × 10 × 15) = 450 m	2 1 1
		(ii)		5 **[18]**

WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk/exams.html