SCOTTISH QUALIFICATIONS AUTHORITY

2005 Physics

Higher

Finalised Marking Instructions

These Marking Instructions have been prepared by Examination Teams for use by SQA Appointed Markers when marking External Course Assessments.

Scottish Qualifications Authority

Detailed Marking Instructions - Higher Physics

1. General Marking Instructions

SQA published Physics General Marking Instructions in July 1999. Please refer to this publication when interpreting the detailed marking instructions.

2. Recording of marks

The following additional advice was given to markers regarding the recording of marks on candidate scripts.

(a) The total mark awarded for each question should be recorded in the outer margin. The inner margin should be used to record the mark for each part of a question as indicated in the detailed marking instructions.

(b) The fine divisions of marks shown in the detailed marking scheme may be recorded within the body of the script beside the candidate's response. Where such marks are shown they must total to the mark in the inner margin.

(c) Numbers recorded on candidate scripts should always be the marks being awarded. Negative marks or marks to be subtracted should not be recorded on scripts.

(d) The number out of which a mark is scored should **never** be recorded as a **denominator**. (½ mark will always mean one half mark and never 1 out of 2)

(e) Where square ruled paper is enclosed inside answer books it should be clearly indicated that this item has been considered by the marker. The mark awarded should be transferred to the script booklet inner margin and marked G.

(f) The mark awarded for each question should be transferred to the grid on the back of the script. When the marker has completed marking the candidate's response to all questions, the marks for individual questions are added to give the total script mark.

(g) The total mark awarded for an individual question may include an odd half mark - ½. If there is an odd half mark in the total script mark, this is rounded up to the next whole number when transferred to the box on the front of the script.

3. Other Marking Symbols which may be used

TICK	–	Correct point as detailed in scheme, includes data entry
SCORE THROUGH	–	Any part of answer which is wrong. (For a block of wrong answer indicate zero marks.)
INVERTED VEE	–	A point omitted which has led to a loss of marks.
WAVY LINE	–	Under an answer worth marks which is wrong only because a wrong answer has been carried forward from a previous part.
"G"	–	Reference to a graph on separate paper. You MUST show a mark on the graph paper and the SAME mark on the script.

4. Marking Symbols which may <u>NOT</u> be used.

"WP"	−	Marks not awarded because an apparently correct answer was due to the use of "wrong physics".
"ARITH"	−	Candidate has made an arithmetic mistake.
"SIG FIGS" or "SF"	−	Candidate has made a mistake in the number of significant figures for a final answer.

Physics − Marking Issues

The current in a resistor is 1·5 amperes when the potential difference across it is 7·5 volts. Calculate the resistance of the resistor.

	Answers	Mark +comment	Issue
1.	V=IR 7·5=1·5R R=5·0Ω	(½) (½) (1)	Ideal Answer
2.	5·0Ω	(2) Correct Answer	GMI 1
3.	5·0	(1½) Unit missing	GMI 2(a)
4.	4·0Ω	(0) No evidence/Wrong Answer	GMI 1
5.	_____Ω	(0) No final answer	GMI 1
6.	$R=\frac{V}{I}=\frac{7\cdot5}{1\cdot5}=4\cdot0\Omega$	(1½) Arithmetic error	GMI 7
7.	$R=\frac{V}{I}=4\cdot0\,\Omega$	(½) Formula only	GMI 4 and 1
8.	$R=\frac{V}{I}=$_____Ω	(½) Formula only	GMI 4 and 1
9.	$R=\frac{V}{I}=\frac{7\cdot5}{1\cdot5}=$_____Ω	(1) Formula + subs/No final answer	GMI 4 and 1
10.	$R=\frac{V}{I}=\frac{7\cdot5}{1\cdot5}=4\cdot0$	(1) Formula + substitution	GMI 2(a) and 7
11.	$R=\frac{V}{I}=\frac{1\cdot5}{7\cdot5}=5\cdot0\Omega$	(½) Formula but wrong substitution	GMI 5
12.	$R=\frac{V}{I}=\frac{75}{1\cdot5}=5\cdot0\Omega$	(½) Formula but wrong substitution	GMI 5
13.	$R=\frac{I}{V}=\frac{7\cdot5}{1\cdot5}=5\cdot0\Omega$	(0) Wrong formula	GMI 5
14.	V=IR 7·5 = 1·5 x R R=0·2Ω	(1½) Arithmetic error	GMI 7
15.	V=IR $R=\frac{I}{V}=\frac{1\cdot5}{7\cdot5}=0\cdot2\Omega$	(½) Formula only	GMI 20

2005 Physics Higher

Marking scheme

Section A

1.	A	11.	E
2.	E	12.	C
3.	C	13.	B
4.	B	14.	B
5.	E	15.	A
6.	B	16.	A
7.	C	17.	D
8.	D	18.	D
9.	E	19.	B
10.	C	20.	D

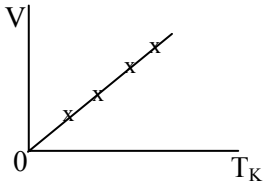
Sample Answer and Mark Allocation	Notes	Inner Margin	Outer Margin
21. (a) (i) (A) $\text{Mean} = \frac{0{\cdot}015 + 0{\cdot}013 + 0{\cdot}014 + 0{\cdot}019 + 0{\cdot}017 + 0{\cdot}018}{6}$ $\text{Mean} = \frac{0{\cdot}096}{6}$ Mean = 0·016 s ***(1)***	(0·02 s ***(1)***) 0·016 s ***(1)*** 0·016 ***(½)*** 0·016 + wrong unit ***(½)*** Any other figure unless due to Arith ***(0)***	***1●***	***8***
(a) (i) (B) $\text{Uncertainty} = \frac{0{\cdot}019 - 0{\cdot}013}{6}$ Uncertainty = (±) 0·001 ***(1)*** Goes on to calculate percentage uncertainty ***(0)***	(±) 0·001 s ***(1)*** (±) 0·001 + wrong unit ***(½)*** (±) 0·001 + wrong unit as in (a) (i) (A) ***(1)*** ie consistent with (a) (i) (A)	***1●***	
(a) (ii) $v = \frac{d}{t} = \frac{0{\cdot}020}{0{\cdot}016}$ ***(½)*** v = 1·25 (m s^{-1}) ***(½)*** – $v^2 = u^2 + 2as$ ***(½)*** $1{\cdot}25^2 = 0 + 2 \times a \times 0{\cdot}60$ ***(½)*** a = 1·30 m s^{-2} ***(1)***	Consistent with (a) (i) (A) $t = \frac{d}{v} = \frac{0{\cdot}6}{0{\cdot}625} = 0{\cdot}96$ $a = \frac{v - u}{t} = \frac{1{\cdot}25 - 0}{0{\cdot}96\ (½)}$ = 1·3 m s^{-2} ***(1)*** Both equations ***(½)*** Wrong v then max (2) unless Arith Allow 1·3 to 1·302	***3●***	

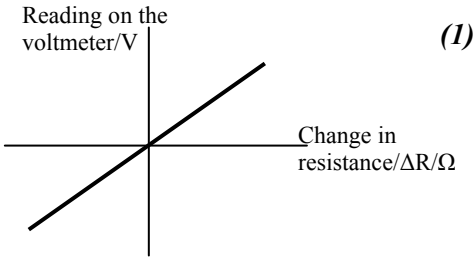
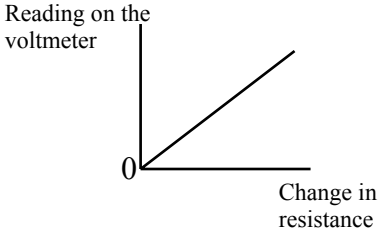
2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
21 (b) (i) Photoconductive ***(1)***	OR photo-conducting ***(1)***	***1***	
(b)(ii) • Positive and negative charge carriers no longer released ***(1)*** OR electron/hole pairs no longer released ***(1)*** OR (photo)diode no longer conducts ***(1)*** OR resistance of (photo)diode increases/higher ***(1)*** OR no current in (photo)diode ***(1)***	Mention LDR – stop marking		
• voltage across photodiode/YZ rises (above 2V) ***(½)*** OR voltage input to MOSFET rises ***(½)***	"voltage at Y" – stop marking		
• causing the MOSFET to conduct ***(½)*** OR switches on MOSFET ***(½)***	Accept transistor Cannot get last ***(½)*** on its own	***2+***	

2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
22. (a) (i) $F = 4{\cdot}5 \times 10^3 \times \cos 21°$ $F = 4{\cdot}2 \times 10^3$ N ***(1)***	4201 N ***(1)*** 4201·1 N ***(½)*** No unit or wrong unit ***(½)*** max • $4{\cdot}2 \times 10^3 \times 2 = 8{\cdot}4 \times 10^3$N ***(½)*** • $8{\cdot}4 \times 10^3$ on its own ***(0)***	***1***	***6***
(a) (ii) Upward Force = $2 \times 4{\cdot}2 \times 10^3 = 8{\cdot}4 \times 10^3$ (N) ***(½)**** Weight = mg = 236 x 9·8 ***(½)**** $= 2{\cdot}3 \times 10^3$ (N) Unbalanced force = $8{\cdot}4 \times 10^3 - 2{\cdot}3 \times 10^3$ ***(½)*** $= 6{\cdot}1 \times 10^3$ (N) F = ma ***(½)**** $6{\cdot}1 \times 10^3 = 236 \times a$ $a = 26$ m s^{-2} ***(1)*** Alternative $a = \frac{F}{m}$ ***(½)**** $= \frac{2 \times 4{\cdot}2 \times 10^3}{236}$ ***(½)**** – ***(½)*** $\frac{236 \times 9{\cdot}8}{236}$ ***(½)**** $a = 26$ m s^{-2} ***(1)***	**** = independent marks*** Consistent with (a)(i) For partial marks F = ma ***(½)**** 2 x (a) (i) ***(½)**** 236 x 9·8 ***(½)**** subtraction ***(½)*** Answer + unit **(1)** OR 25·8 m s^{-2} **(1)** g = 10 then max ***(2½)*** a = 36 m s^{-2} then max ***(1)***	***3+***	
(a) (iii) Force exerted by the cord decreases (with height) ***(1)*** Tension decreases ***(1)***	• Force on capsule decreases ***(0)*** • Unbalanced force on capsule decreases ***(1)*** • Angle between cord and vertical increases decreasing the component ***(1)*** • Force decreases ***(0)***	***1•***	

2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
(b) Both the occupants and the seats/capsule are accelerating towards the ground with an acceleration of 9·8 m s^{-2} ***(1)***	Must include 9·8 m s^{-2} OR with an acceleration of g OR due to gravity OR they are in free fall	***1+***	

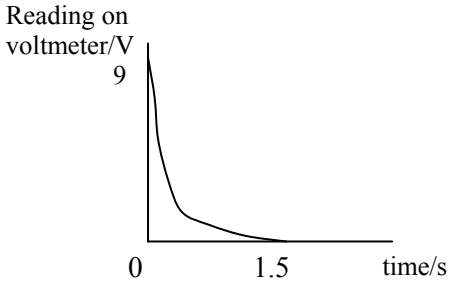
2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
23. (a) $\rho = \frac{m}{V}$ *(½)* $= \frac{0{\cdot}012}{0{\cdot}50 \times 0{\cdot}30 \times 0{\cdot}10}$ *(½)* $= 0{\cdot}8$ kg m^{-3} ***(1)***	OR 800 g m^{-3} Watch for 0·8kgm^{-2}	***2***	*7*
(b) • Pressure ∝ depth *(½)* OR P = ρgh *(½)* • Pressure on the bottom surface is greater than pressure on the top surface *(½)* • Force on the bottom surface is greater than the force on the top surface ***(1)*** • OR Net force upwards ***(1)***	• Must have one or both of the first two statements before final ***(1)*** can be awarded • Described in terms of the Principle of Archimedes ***(0)***	***2***	
(c) • Decreases ***(1)*** • Force of friction (drag) increases as the speed increases ***(1)*** • Decreases because unbalanced force is less ***(1)***	Must make an attempt at an explanation which is not wrong Physics to gain first ***(1)*** Poor use of language Eg Acceleration slowing down followed by correct explanation – second ***(1)*** awarded only Must refer to water resistance and speed	***2+***	
(d) • Acceleration will be **less** because *(½)* • the mass (or weight) is greater *(½)* or heavier OR unbalanced force is less *(½)*	Poor language ***(0)*** Must make an attempt at an explanation which is not wrong Physics to gain first *(½)*	***1+***	

2005 Physics - Higher							
Sample Answer and Mark Allocation					**Notes**	Inner Margin	Outer Margin
24. (a) (i)							***9***
	T/K	298	323	348	373		
	V/T	0·069	0·070	0·069	0·068		
OR	T/V	14·5	14·3	14·5	14·7		
						Temp not in Kelvin *(0)* For all four V/T values *(1)* For each V/T wrong OR missing *(–½)*	
$\frac{V}{T}$ = a constant (1) OR $\frac{V}{T}$ = 0·069 **(1)**						Accept: 0·07	***2●***
OR $\frac{T}{V}$ = a constant = 14·5 OR $\frac{V_1}{T_1} = \frac{V_2}{T_2}$							
Graph: 						Ignore unit unless wrong ***(-½)*** Deduct (½) for each label missing Deduct (½) for each wrong/missing point	
						$\frac{T}{V}$ = 14·5 on its own ***(1)*** $\frac{V}{T}$ = A constant on its own ***(0)*** $\frac{V}{T}$ = 0·069 on its own ***(1)***	
(a) (ii) $\frac{V}{T}$ = a constant ***(½)*** V = 0·069 x (65 + 273) ***(½)*** = 0·069 x 338 V = 23·3 ml ***(1)***						Consistent with (a)(i) Temp not in Kelvin ***(½)*** max	***2***
OR $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ ***(½)*** $\frac{V_1}{T_1} = \frac{V_2}{338}$ V_1 and T_1 are correct values from table ***(½)*** V_2 = 25°C → 23·4 ml; 50°C → 23·6 ml; 75°C → 23·3 ml; 100°C → 23·0 ml **(1)**						• Value taken from graph (*0*)/celsius • Calculate gradient then correct value ***(2)*** • $\frac{V}{T}$ = 0·07 => V = 23·66 ml (2) • Not 23·1, 23·2, 23·5 ***(0)*** unless calculation shown.	

Sample Answer and Mark Allocation	Notes	Inner Margin	Outer Margin
(a) (iii) • As the temp increases the particles <u>move</u> faster/with greater kinetic energy/increased momentum *(½)* • The (average) force exerted by the particles on walls/ container/syringe increases *(½)* OR the force goes up ∵ the particles hit the walls more often *(½)* OR the particles have a larger change in momentum per second *(½)* OR the particles hit walls harder • The volume increases (to increase the surface area) *(½)* • Keeping the pressure constant *(½)* OR to increase the surface area *(½)*	Must make reference to particle movement for any marks Pressure increases (WP) Anywhere except Pressure would increase then volume increases *(½)* to keep pressure constant *(½)*	***2***	
24 (b) (i) $\frac{R_1}{R_2} = \frac{R_3}{R_4}$ $\frac{R}{500} = \frac{2000}{1000}$ *(1)* R = 1000 Ω *(1)*	No formula *(½)*	***2***	
(b) (ii)  *(1)*  *(½)*	Origin label not required in this case Deduct (½) for R or Resistance One quadrant max *(½)* Origin required	***1•***	

2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
25. (a) The energy given to each coulomb of charge <u>passing through</u> the source/circuit OR p.d. across the battery terminals when no current is drawn OR open circuit voltage OR T.P.D + lost volts	 Not: emf in words Total voltage ***(0)*** Formula ***(0)***	***1***	***7***
(b) (i) (A) 6 V ***(1)***	 $6{\cdot}0 \pm 0{\cdot}1$ V ***(1)*** $6{\cdot}0 \pm 0{\cdot}1$ ***(½)*** $6{\cdot}0 \pm 0{\cdot}1$ + wrong unit ***(½)***	***1•***	
(b) (i) (B) $r = \frac{E - V}{I}$ ***(½)*** $r = \frac{6 - 4{\cdot}5}{0{\cdot}3}$ ***(½)*** r = 5·0 Ω ***(1)*** OR r = (-) gradient ***(½)*** $= \left(\frac{5-1}{0{\cdot}2-1}\right)$ ***(½)*** = 5Ω ***(1)*** OR $R = \frac{V}{I}$ ***(½)*** $= {}^{3}\!/_{0.6}$ ***(½)*** = 5 Ω ***(1)***	 Consistent with (b) (i) (A) Can use any appropriate values from graph r = –5Ω ***(1½)***	***2•***	
(b) (ii) V = IR***(½)*** 4·5 = 0·3 R ***(½)*** R = 15 Ω	Consistent with (b) (i) OR $E = IR_{total}$ ***(½)*** 6 = I x (5 +15) ***(½)*** I = 0·30 A No final answer max ***(½)***	***1***	

2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
25. (c) Combined resistance in parallel = $\frac{30 \times 15}{45}$ = 10 (Ω) ***(1)*** E = IR 6 = I (10 + 5) ***(½)*** I = 0·4 (A) ***(½)*** (This is the reading on ammeter)	$R_T = \frac{1}{R^1} + \frac{1}{R^2}$ (wp) ***(0)*** $\frac{1}{R} = \frac{1}{15} + \frac{1}{30}$ R = 10 (Ω) ***(1)*** Consistent with (b) (i) (B) and (b) (i) (A)	***2***	

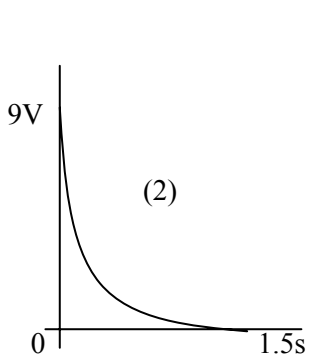
2005 Physics - Higher **Sample Answer and Mark Allocation**	**Notes**	Inner Margin	Outer Margin
26. (a) (i)  	Axes must be labelled Wrong shape ***(0)*** Shape correct ***(1)*** Then 9 (V) ***(½)*** 1·5 (s) ***(½)*** On separate sheet	***2***	***10***
(a) (ii) • Time will be longer ***(½)*** • Initial (charging) current will be less ***(½)*** OR average current will be less ***(½)*** OR current at any time will be less ***(½)*** OR current at all times will be less ***(½)***	• Must attempt explanation • Time longer on its own ***(0)*** • Time longer ∵ R increases ***(0)*** • Time longer ∵ current less ***(½)***	***1•***	
(a) (iii) $C = \frac{Q}{V}$ ***(½)*** $2200 \times 10^{-6} = \frac{Q}{5}$ ***(½)*** $Q = 0{\cdot}011$ C ***(1)*** But $Q = CV = 2200 \times 10^{-6} \times 4 = 8800 \times 10^{-6}$ C ***(½)*** $Q = 2200 \times 10^{-6} \times 4 = 8800 \times 10^{-6}$ C ***(0)***	***(½)*** for correct substitution ***(1)*** for 5 (V) anywhere • If V = 4V max ***(½)***	***3+***	
(b) (i) $E = ½ CV^2$ ***(½)*** $E = ½ \times 2200 \times 10^{-6} \times 9^2$ ***(½)*** $E = 8{\cdot}9 \times 10^{-2}$ J ***(1)*** OR $Q = CV = 2200 \times 10^{-6} \times 9 = 1{\cdot}98 \times 10^{-2}$ (C) $E = ½QV$ ***(½)*** $E = 0{\cdot}5 \times 1{\cdot}98 \times 10^{-2} \times 9$ ***(½)*** $E = 8{\cdot}9 \times 10^{-2}$ J ***(1)***	No square or no 81 shown then formula ***(½)*** only Both formulae for ***(½)***	***2***	
(b)(ii) $V = IR$ ***(½)*** $9 = I \times 100 \times 10^3$ ***(½)*** $I = 9 \times 10^{-5}$ A ***(1)***		***2***	

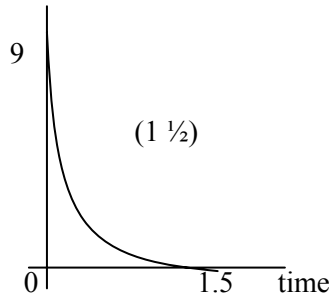
26. (a) (i)

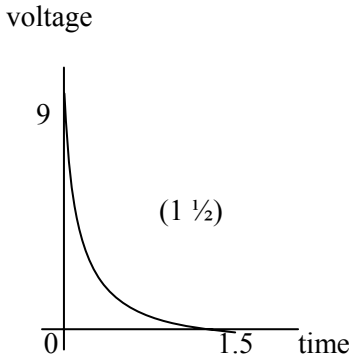
- Correct shape ***(1)*** (needed for any marks)
- Line starts at 9 ***(½)***
- Line finishes at 1.5 ***(½)***

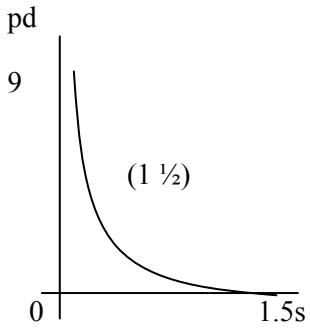
But

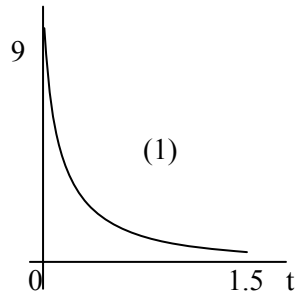
- Deduct (½) if no origin given
- Deduct (½) if no V next to 9 OR V OR pd OR voltage OR appropriate label given
- Deduct (½) if no s next to 1.5 OR t OR time label given

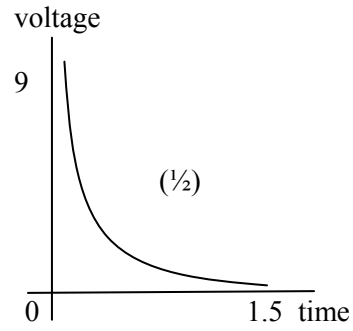


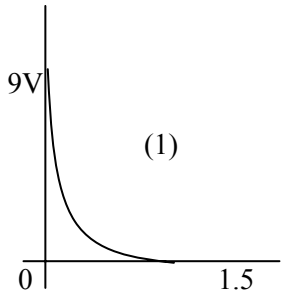


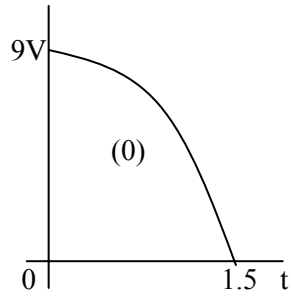


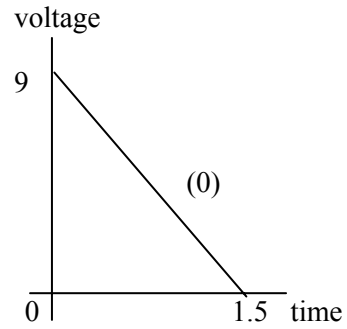


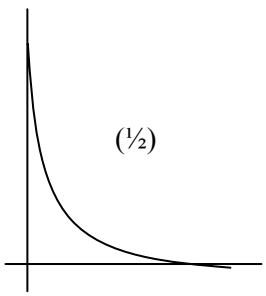


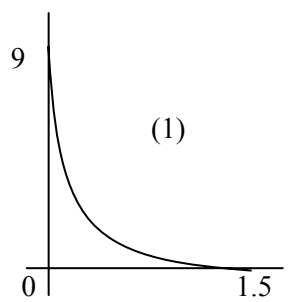


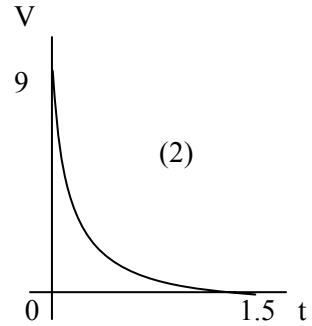




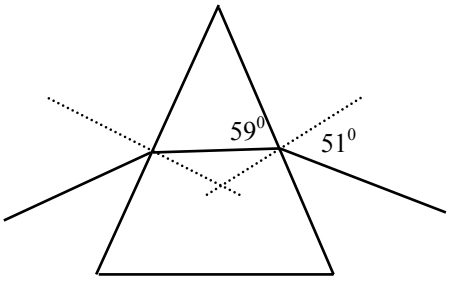








2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
27 (a) X = Source; Y = Gate; Z = Drain	***(1)*** for all three correct	***1***	***5***
(b) (i) $V_0 = \frac{R_f}{R_1}(V_2 - V_1)$ ***(½)*** $2 = \frac{1 \times 10^6}{500 \times 10^3}(V_2 - V_1)$ ***(½)*** $(V_2 - V_1) = 1$ V ***(1)***		***2***	
(b) (ii) $I = \frac{V}{R} = \frac{12}{120 \times 10^3} = 1 \times 10^{-4}$ (A) $V_{20k} = 1 \times 10^{-4} \times 20 \times 10^3$ ***(½)*** = 2 (V) $V_{th} = 2 + 1 = 3$ (V) ***(½)*** consistent with (b)(i) $I = \frac{9}{75 \times 10^3} = 1{\cdot}2 \times 10^{-4}$ (A) ***(½)*** $R_{th} = \frac{3}{1{\cdot}2 \times 10^{-4}} = 2{\cdot}5 \times 10^4\ \Omega$ ***(½)***	$V_{20k} = \frac{20}{120} \times 12$ ***(½)*** = 2 (V) $V_{th} = 2 + 1 = 3$ (V) ***(½)*** $\left[\frac{V_{th}}{V_{75k}} = \right]\frac{3}{9} = \frac{R_{th}}{75k}$ ***(½)*** $R_{th} = 2{\cdot}5 \times 10^4\ \Omega$ ***(½)*** $R_{th} = 25\ k\Omega$ No unit/wrong unit max ***(1½)*** $\frac{R_{th}}{R_{th} + 75} \times 12 = 3$ ***(1)***	***2+***	

2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
28 (a) (i) $n = \frac{\sin\theta_1}{\sin\theta_2}$ OR $\frac{\sin\theta_{air}}{\sin\theta_{glass}}$ ***(½)*** OR $\frac{\sin i}{\sin r}$ ***(½)*** $n = \frac{\sin 47^{(\circ)}}{\sin 29^{(\circ)}}$ ***(½)*** n = 1·51 ***(1)***	$n = \frac{\sin 43}{\sin 6}$ max ***(½)*** 1·50 on its own ***(0)*** 1·5 on its own ***(2)*** If unit given max ***(1½)*** Calculator in radians n = -0·19 ***(1½)*** max Calculator in gradians n = 1·53 ***(1½)*** max	***2•***	***8***
(a) (ii)  	59^0 or 31^0 ***(½)*** 51^0 or 39° ***(1½)*** – consistent with (a) (i) If ° missing ***(1½)*** max $1{\cdot}51 = \frac{\sin\theta}{\sin 31}$ ***(1)*** only if angle shown on diagram θ = arithmetic error Protractor: 59° ± 1° 58° ➔ 53° 60° ➔ 49°	***2+***	
(b) (i) Bigger crests and troughs Constructive interference ***(½)*** Bigger amplitude Waves are meeting/in phase /in step /crest + crest and trough + trough ***(½)*** /pd = nλ /by diagram ∿ + ∿ ⇒ ∿ ***(1)***	Independent marking	***1***	

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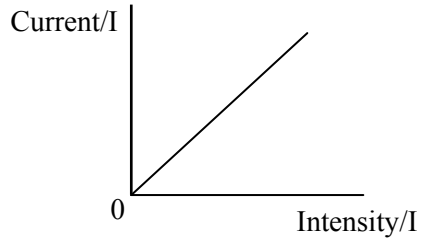
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
(b) (ii) $d \sin\theta = n\lambda$ *(½)* $\frac{1\times10^{-3}}{300} \sin\theta$ *(½)* $= 2 \times 650 \times 10^{-9}$ *(½)* $\theta = 23°$ *(½)* But $\frac{1}{300} \sin\theta = 2 \times 650 \times 10^{-9}$ $\theta = 0{\cdot}022°$ *(1½)*	$300\sin\theta = 2 \times 650 \times 10^{-9}$ max *(1)* If ^{0} missing max *(1½)* Watch for $d \sin\theta = n\lambda$ *(½)* *(½)* $0{\cdot}003 \sin\theta = 2 \times 650 \times 10^{-6}$ *(½)* $\theta = 25{\cdot}7^0$ *(½)*	***2***	
(b) (iii) The fringes are closer together *(½)* wavelength of blue light < λ of red light *(½)* OR frequency of blue light > f of red light OR λ blue is smaller OR f greater Angle θ smaller ∴ λ blue < λ red *(½)*	Fringes closer together on its own or with wrong Physics *(0)* Refraction (wp) Shorter wavelength diffracts less max *(½)*	***1+***	

2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
29 (a)  ***(1)***	Must be labelled No origin max ***(½)***	***1***	***5***
(b) (i) $E\ (= hf) = \frac{hc}{\lambda}$ ***(½)*** $E = \frac{6{\cdot}63 \times 10^{-34} \times 3{\cdot}0 \times 10^{8}}{400 \times 10^{-9}}$ ***(½)*** $E = 4{\cdot}97 \times 10^{-19}$ ***(½)*** – $E_k = 4{\cdot}97 \times 10^{-19} - 3{\cdot}11 \times 10^{-19}$ ***(½)*** $E_k = 1{\cdot}86 \times 10^{-19}$ J ***(1)*** OR $\frac{hc}{\lambda}$ ***(½)*** $= hf_0 + E_K$ $\frac{6{\cdot}63 \times 10^{-34} \times 3{\cdot}0 \times 10^{8}}{400 \times 10^{-9}}$ ***(½)*** $= hf_0 + E_K$ $4{\cdot}97 \times 10^{-19}$ ***(½)*** $= 3{\cdot}11 \times 10^{-19} + E_K$ ***(½)*** $E_K = 1{\cdot}86 \times 10^{-19}$ J ***(1)***	$v = f\lambda$ $3 \times 10^{8} = f \times 400 \times 10^{-9}$ $f = 7{\cdot}5 \times 10^{14}$ (Hz) $E = hf$ and $v = f\lambda$ ***(½)*** $E = 6{\cdot}63 \times 10^{-34} \times 7{\cdot}5 \times 10^{14}$ ***(½)*** $E = 4{\cdot}97 \times 10^{-19}$ ***(½)*** $E_K = 4{\cdot}97 \times 10^{-19}$ J max ***(1 ½)*** $E_K = \frac{hc}{\lambda}$ WP ***(0)*** $1{\cdot}8625 \times 10^{-19}$ J ***(3)***	***3•***	
(b) (ii) Some electrons may have enough (kinetic) energy to travel from the (metal) plate to the (metal) cylinder ***(1)***		***1+***	

2005 Physics - Higher			
Sample Answer and Mark Allocation	**Notes**	Inner Margin	Outer Margin
30 (a) (i) Half value thickness = 5 mm ***(1)***	 5 ***(½)*** 5 + wrong unit ***(½)*** Any other figure + mm***(0)*** 5·0 ± 0.1 mm ***(1)*** half life = 5mm ***(0)*** $T_{1/2}$ = 5mm ***(1)***	***1***	***5***
(a) (ii) 20 $>$ 5 10 3 x 5 = 15 mm ***(1)*** $>$ 5 5 $>$ 5 2.5 ***(1)***	 15 mm ***(2)*** consistent with (a) (i) ignore half-life 15 ***(1½)***	***2***	
(b) H = DQ ***(½)*** $H = D_1Q_1 + D_2Q_2 + D_3Q_3$ $H = (1 \times 2 \times 10^{-3}) + (3 \times 400 \times 10^{-6}) + (10 \times 80 \times 10^{-6})$ ***(½)*** $H = 4 \times 10^{-3}$ (Sv) = 4 (mSv) Number of hours = $\frac{500 \times 10^{-3}}{4 \times 10^{-3}}$ Number of hours = 125 (h) ***(1)***	 125 + wrong unit ***(1½)***	***2•***	

[END OF MARKING INSTRUCTIONS]