GCE A LEVEL MARKING SCHEME

SUMMER 2024

A LEVEL
PHYSICS – UNIT 4
1420U40-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCE A LEVEL PHYSICS

UNIT 4 – FIELDS AND OPTIONS

SUMMER 2024 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

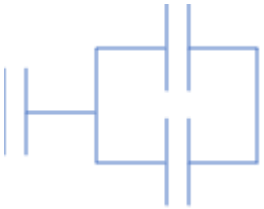
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

SECTION A

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
1	(a)		Capacitance equation used i.e. $C = \frac{\varepsilon_0 A}{d}$ (1) Area = d^2 and cm conversion (7.569×10^{-3} m^2) (1) Correct separation (2.91×10^{-4} m or 0.291 mm etc.) (1)	1	1 1		3	2	
	(b)		Using $Q = CV$ e.g. 87 [V] **or** substituting (1) Using the energy equation i.e. $\frac{Q^2}{2C}$ (1st mark implied) (1) Final answer = 2.035×10^{-8} [C] or 20.35 n[C] **hence** correct (1) e.g. 0.87 μJ ≈ 0.9 μJ Accept 0.87 μ[J], 222 p[F]			3	3	3	
	(c)		Same pd or full pd [to each C] (1) Same charge [on each C] **OR** $C = \frac{Q_{total}}{V} = \frac{Q+Q}{V}$ **OR** $C = \frac{Q_1 + Q_2}{V}$ (1) Hence double charge **OR** $C = \frac{Q}{V} + \frac{Q}{V}$ **OR** $C = \frac{Q_1}{V} + \frac{Q_2}{V}$ i.e. seeing that capacitances can be added (1)		3		3		
	(d)		2×230 pF in parallel and then 230 pF in series 		1		1		
			Question 1 total	**1**	**6**	**3**	**10**	**5**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2			**Method** Diagram of charging circuit. Description of how to charge. Diagram of discharging circuit. Description of how to discharge. Collection of data described i.e. every 20 s measure V etc Valid meter correctly placed. **Analysis** A discharging equation given e.g. $I = I_0 e^{-\frac{t}{RC}}$ **or** $\ln V = \ln V_0 - \frac{t}{RC}$ Correct graph stated e.g. I v t, V v t, Q v t, $\ln V$ v t. Valid method for time constant e.g. 37% left **OR** $\frac{-1}{\text{gradient}}$ Shape of graph described / shown correctly (i.e. exponential decay shape **OR** straight and negative gradient). Statement that time constant = RC (for comparison etc)	6			6	1	6

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
			5-6 marks Comprehensive description of both the method and analysis. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3-4 marks** Comprehensive description of either the method or analysis or limited description of both provided. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.* **1-2 marks** Limited description of either the method or analysis *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure.* **0 marks** *No attempt made or no response worthy of credit.*						
			Question 2 total	**6**	**0**	**0**	**6**	**1**	**6**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		Use of Doppler equation (1) Obtaining data from graph i.e. mean shift = $(4.6 \pm 0.1) \times 10^{-15}$ m **OR** max and min = 5.55 [$\times 10^{-15}$ m] and 3.65 [$\times 10^{-15}$ m] **OR** max = 5.55 [$\times 10^{-15}$ m] and 2.54 [$m\,s^{-1}$] (1) Amplitude = $(0.95 \pm 0.1) \times 10^{-15}$ [m] **OR** velocities = 1.67 and 2.54 [$m\,s^{-1}$] **OR** minimum = 3.65 [$\times 10^{-15}$ m] and 1.67 [$m\,s^{-1}$] (1) All penultimate steps seen or correct values to extra d.p. seen e.g. $\frac{3 \times 10^{8} \times 0.95 \times 10^{-15}}{656 \times 10^{-9}}$ **and** $\frac{3 \times 10^{8} \times 4.6 \times 10^{-15}}{656 \times 10^{-9}}$ (1) N.B. obtaining 0.43 [$m\,s^{-1}$] **or** 2.1 [$m\,s^{-1}$] gains the 1st 3 marks	1	1 1 1		4	3	
	(b)		Blue **and** shorter wavelength (or squashed or equivalent or negative shift) Accept negative velocity Don't accept because it is negative	1			1		
	(c)		Use of $v = \frac{2\pi R}{T}$ **OR** equivalent ($v = \omega R$ **and** $\omega = \frac{2\pi}{T}$) (1) T = 390 ± 10 days obtained from graph (1) Final sub seen **or** correct extra dp seen e.g. $R = \frac{0.4 \times 390\ \textbf{ecf} \times 24 \times 3600}{2\pi}$ **OR** 2145 km etc (1) N.B. use of this equation is incorrect $d^3 = \frac{GMT^2}{4\pi^2}$		3		3	2	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)	Use of period equation (1) Algebra (minimum $d^3 = \frac{GMT^2}{4\pi^2}$) (1) Answer: d = 1.57 × 10^{11} m (1) **ecf** on T N.B. deriving the equation is ok Don't accept $v^2 = \frac{GM}{r}$ with tiny speed	1	1 1		3	2	
		(ii)	Use of C of M equation N.B. be generous on substitution (1) Mass = 3 × 10^{25} [kg] (1) **ecf**	1	1		2	2	
	(e)		**1× bad point / something to do with mass** e.g. gravity stronger, no idea of atmosphere etc. don't accept gravity between star and planet greater **1× good point / linked to intensity of light** e.g. temperature about right, habitable zone, water possible **1× conclusion linked to a point** (even if the point isn't quite deserving of the mark e.g. No, it's too hot - 1 mark) e.g. Yes because water possible (this is 2 marks) Accept 2 different conclusions or even sitting on the fence			3	3		
			Question 3 total	**4**	**9**	**3**	**16**	**9**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	Minimum answer = force per unit charge (accept force per coulomb)	1			1		
		(ii)	Use of field equation $E = \frac{kQ}{r^2}$ (1) Distance = $0.6\sqrt{2}$ **OR** $\frac{1.2}{\sqrt{2}}$ **OR** 0.85 [m] **OR** equivalent with sin **OR** cos45 (1) accept $r^2 = 0.72$ [m^2] Penultimate step seen **OR** 524 5XX seen for field (1) N.B. $k = 9 \times 10^9$ gives exactly 525 000	1	1 1		3	2	
		(iii)	Left (independent) **or** arrow pointing left (1) $\div \sqrt{2}$ seen **or** ×sin45 **or** ×cos45 (1) Final answer correct = 1 485 000 [N C^{-1}] (1)		3		3	2	
	(b)	(i)	Minimum answer – {work done / energy required} per unit charge from infinity (accept {work done / energy required} per coulomb from infinity)	1			1		
		(ii)	[Potential of] +ve and -ve charges cancel (1) Because equidistant **OR** because the same distance (1) accept P is at the centre **OR** mathematical: Potential equation used (1) An expression for 4 potentials seen to reduce to zero (k not needed) (1)	1	1		2		
		(iii)	Right and left force confirmed / agreed with (however stated e.g. accelerates right then decelerates is ok) (1) One of the two forces explained (we'll allow 2nd by implication) e.g. initially repulsed by -ve **OR** left force later because (closer to) +ve charges (1) E = 0 at infinity stated **or** explained somehow (1)			3	3		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iv)	Potential equation used (e.g. 630 000, -282 000) (1) Potentials added and subtracted (696 000) (1) WD = $q\Delta V$ used (± 0.0264) (1) Energy (not potential) equated to $\frac{1}{2}mv^2$ (1) Final answer (8.3 m s^{-1}) (1) **Alternative:** Potential equation used (-0.02394, +0.0107) (1) PEs added and subtracted (1) Value correct (± 0.0264) (1) Equated to $\frac{1}{2}mv^2$ (1) Final answer (8.3 m s^{-1}) (1) **Award a maximum of 3 marks for:** Any attempt at $a = \frac{F}{m}$ (1) expect a = 73.3) Any attempt at use of equations of motion (1) i.e. $v^2 = u^2+2ax$ Answer of 9.4 [m s^{-1}] (1) **Answers that score 4 marks:** 5.86 [m s^{-1}], 2 charges instead of 4 Power of 10 – cm instead of m should be 83 [m s^{-1}], same applies to mC instead of nC – out by a factor of 1000. Unfortunately, nC instead of μC will be out by a factor of $\sqrt{1000}$ = 31.6 [m s^{-1}] 7.46 [m s^{-1}] and 11.15[m s^{-1}]	1 1	 1 1 1		 5	 3	
			Question 4 total	**6**	**9**	**3**	**18**	**7**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		Earth's magnetic field mentioned			1	1		1
	(b)		$\ln a$ = -3.22 (1) 0.000 127 **and** -8.97 for B and $\ln B$ (1) Data point within ½ square (1) **ecf**	1	1 1		3	3	3
	(c)		Method for gradient (1) Answer = -0.94 ± 0.01 (no penalty for missing minus) (1)	1	1		2	2	2
	(d)		Taking logs correctly e.g. $\ln B = \ln\left(\frac{\mu_0 I}{2\pi}\right) + \ln\left(\frac{1}{a}\right)$ (1) accept $\ln B = \ln\left(\frac{\mu_0 I}{2\pi a}\right)$ In correct form e.g. $\ln B = -\ln a + \ln\left(\frac{\mu_0 I}{2\pi}\right)$ (1)		2		2	1	2
	(e)		**Any 3 × (1) from:** -Straight line -Through all error bars or close to points or small scatter -Gradient close to -1 -Intercept -12 agrees with small permeability			3	3	3	3

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(f)		At least one intercept read from the graph (-12.0 to -12.3) (1) Equating intercept to $\ln\left(\frac{\mu_0 I}{2\pi}\right)$ (1) A value of I obtained (23 A to 31 A) (1) Attempt at 2 values of I from 2 intercepts (regardless of mistakes) (1) I = (27 ± 4) A **OR** (26.7 ± 4.0) A **ecf UNIT MARK and** value for absolute uncertainty to 1 or 2 sig figs and consistent dps with I (1) **Award a maximum of 4 marks for:** Using a data point (from table or graph) (1) Getting a value for I (1) Getting 3-6 values of I (from table) **or** doing the max / min analysis on the data point (1) Expect I = 25.2 ± 1.2 A **UNIT MARK and** value for absolute uncertainty to 1 or 2 sig figs and consistent dps with I (1) N.B. % method produces 1.2% which is far too small			5	5	3	5
	(g)		Data equally spaced for log (1) Data bunched (bottom left) in other graph (1)			2	2		2
			Question 5 total	**2**	**5**	**11**	**18**	**12**	**18**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		Attempt at starting from Faraday's law e.g. $\frac{BA}{t}$ (1) Clear explanation leading to Bvd – minimum $\frac{BA}{t} = \frac{Bxd}{t} =$ Bdv **OR** area in 1 s is dv (1)	2			2	1	
	(b)	(i)	Flux in **or** right pd (in 1 s) = B_2vd (1) Flux out **or** left pd (in 1 s) = B_1vd (1) Net flux change **or** pd around the loop (per s) = B_2vd - B_1vd (1) **Alternative:** $V = \frac{d}{dt}(BA) = \frac{AdB}{dt}$ (1) $V = \frac{AdB}{dx}\frac{dx}{dt}$ (1) $V = d^2\left(\frac{B_2 - B_1}{d}\right)v$ QED (1) **Award 2 marks for:** pd on right = B_2vd pd on left = B_1vd Hence B_2vd - B_1vd **Award 1 mark for:** It depends on the change in flux / B Hence ΔBvd	1	1 1		3	1	
		(ii)	B_2 - B_1 = 1.20 × 0.038 (1) Answer = 15.25 m[V] or 1.2 × 0.038 × 8.8 × 0.038 seen (1)		2		2	2	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iii)	Length = 4 × 3.8cm (1) Area = 2.2 mm × 2 mm (1) Resistivity equation used (0.55 mΩ) (1) $I = \frac{V}{R}$ used (1) Correct answer = 28 [A] (1) **ecf** 56 A and 111 A award 4 marks	1 1	1 1 1		5	3	
			Question 6 total	**5**	**7**	**0**	**12**	**7**	**0**

SECTION B

Option A – Alternating Currents

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)	Reactance (accept impedance/resistance) of inductor increases with frequency (1) Resistor takes a smaller portion of pd (**OR** current decreases so pd across R decreases) (1)	2			2		
		(ii)	Equating $\omega L = R$ (1) Answer = 141 k[Hz] (1)		2		2	2	
		(iii)	Correct method (implied by correct answer) (1) Answer = 1.77 [V] (1.25 [V] no marks) (1)		2		2	1	
	(b)	(i)	Flux proportional to B (1) Flux proportional to A (1) Same flux for each turn (N) (1) **OR** using Faraday's e.g. $V = \frac{\mathrm{d}}{\mathrm{dt}}(BAN\cos\theta)$ (1) Taking B and A outside bracket (1) Stating B and A are constants (1) **OR** Faraday's law stated (1) Correct explanation of rate of change of flux with reference to cutting of field lines, linked to B (1) Correct explanation of rate of change of flux with reference to cutting of field lines, linked to A (1)	3			3		
		(ii)	When flat (or wtte) because cutting at right angles **OR** flat because max rate of change of flux	1			1		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	Answer = 152 m[A]		1		1	1	
		(ii)	Correct angular frequency obtained (28 072) **OR** f_0 = 4468 [Hz] **OR** $2 \times f_0$ = 8932 [Hz] (1) Correct use of impedance equation i.e.1140 [Ω] (1) Rearrangement of $I = \frac{V}{Z}$ (1) **ecf** on Z Correct answer = 11 m[A] (1)		4		4	4	
	(d)		Multiplying 240 [mV] by $\sqrt{2}$ [= 339 [mV]] (1) Dividing by y-sensitivity (**ecf** on 240) (1) Using $T = \frac{1}{f}$ (14.8 μs) (1) Dividing by time div (7.4 squares) (1) Time base good (one and 1/3 wave ok) **AND** y-sensitivity gives too small a height (independent mark & may well imply the other 4 marks if seen alone) (1)			5	5	2	
			Question 7 total	**6**	**9**	**5**	**20**	**10**	**0**

Option B – Medical Physics

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			Two graphs one completely above the other labelled high voltage with a skewed normal distribution (1) Line spectrum in the same place on both graphs (1) Minimum wavelengths on both graphs labelled and not at (0,0) (1) Minimum wavelengths given as 4.125×10^{-11} and 2.5×10^{-11} [m] (1)	1 1 1	1		4	4	
	(b)	(i)		Rearrangement: $v = \frac{\Delta f c}{2 f \cos\theta}$ (1) v = 0.12 [m s^{-1}] (1)		2		2	2	
		(ii)		Monitor thinning arteries / clots / foetus (development) etc Accept high heart rate		1		1		
	(c)	(i)		Hydrogen nuclei / protons precess about B-field (1) Absorbing radio waves causes flip / change orientation (1) Flipping back (of nuclei precession) emits radio waves (1)	3			3		
		(ii)		Frequency = 5.96×10^{7} [Hz] (1) Wavelength = 5.0[3] [m] (1) Deduct 1 mark for power of 10 errors		2		2	2	
	(d)	(i)		**Either** $2 \times m_e \times 931 = 2 \times$ gamma energy **OR** $m_e \times 931 =$ gamma energy **OR** in numbers **OR** $0.000549 \times 1.67 \times 10^{-27} \times c^2$ (1) Correct answer = 0.511 MeV **OR** 8.20×10^{-14} J (1) Award 1 mark only for answer of 1.02 Deduct 1 mark for power of 10 errors		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Expensive / needs a cyclotron		1		1		
	(e)			X-rays are ionizing damage the foetus (1) Fluoroscopy is also ionizing (1) B scan (ultrasound) is ideal / good (1) A scan only gives the depth of the foetus (in the womb) (1) CT scans are ionizing and would damage the foetus (1) Penalise once only for harmful radiation			5	5		
				Question 8 total	**6**	**9**	**5**	**20**	**10**	**0**

Option C – The Physics of Sports

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)	Any valid moment of inertia equation used i.e. $I = kmr^2$ (1) Valid conclusion based on value of moment of inertia of C with all values for A and B also considered (1)			2	2	1	
		(ii)	Angular momentum $L = I\omega$ used (1) Angular momentum = 22 [kg m^2 s^{-1}] (1)	1	1		2	1	
	(b)	(i)	Angular acceleration = $\frac{\text{change in angular velocity}}{\text{time used}}$ (1) Angular acceleration = 1 256 [rad s^{-2}] (1) Moment of inertia = 7.35 $\times$ 10^{-5} [kg m^2] (1) Torque = 0.099 [N m] (1)	1	1 1 1		4	3	
		(ii)	Rotational kinetic energy $= \frac{1}{2}I\omega^2$ used (1) Rotational KE = 2.5 [J] (**ecf** on I and angular velocity) (1)	1	1		2	2	
		(iii)	Ball has linear and rotational KE or recall $F = \frac{mv-mu}{t}$ (1) Energy has to be dissipated or the glove will <u>increase time</u> of contact when being caught (1) Reduce the effect of friction on the hand (1)	1	1 1		3		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	The velocity of the ball has reduced so KE is decreased as well as potential energy (1) By conservation of energy – energy lost against air resistance (1) **Alternative:** Both horizontal components of velocity calculated i.e. 36 cos3° and 33 cos7° (= 35.95 m s^{-1} and 32.75 m s^{-1} respectively) (1) Horizontal component of velocity has decreased so air resistance is present (1)		2		2		
		(ii)	Both vertical components calculated correctly i.e. 36sin3° = 1.89 [m s^{-1}] and 33sin7° = 4.02 [m s^{-1}] (1) Substitute values into a valid equation of motion e.g. $\frac{v^2-u^2}{2ax}$ i.e. $\frac{4.02^2 - 1.89^2}{2 \times 0.75}$ (1) Valid conclusion (1) e.g. acceleration = 8.39 [m s^{-2}] so not equal to g **or** Height = 0.64 [m] (with g = 9.81m s^{-2}) so not equal to 0.75 [m] **Or** vertical velocity = 4.22 [m s^{-1}] (with g = 9.81 m s^{-2}) so not equal to 4.02 [m s^{-1}]			3	3	3	
		(iii)	A lift force [is created by a spinning ball] (1) can be implied Due to pressure or velocity <u>difference</u> caused by the spinning or equivalent explanation (1)	2			2		
			Question 9 total	**6**	**9**	**5**	**20**	**10**	**0**

Option D – Energy and the Environment

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)	Weak force interaction	1			1		
		(ii)	LHS: 2.01456 u and RHS: 2.01410 u **or** $\Delta m = 4.6 \times 10^{-4}$ u (1) E = 0.428 M[eV] **or** 6.85 $\times 10^{-14}$ [J] (1)		2		2	2	
	(b)	(i)	Solar power received per unit area [crossing a plane] accept intensity (1) At right angles to the line joining the earth to the sun, just outside the earth's atmosphere (1)	2			2		
		(ii)	Not 'constant' due to varying solar power output/Earth's elliptical orbit			1	1		
		(iii)	Stefan-Boltzmann **OR** Stefan **OR** Inverse square law (1) $P = \sigma AT^4 = 5.67 \times 10^{-8} \times 6.1 \times 10^{18} \times 5\,780^4 = 3.9 \times 10^{26}$ (1) $I = \frac{P}{A} = \frac{P \textbf{ ecf}}{4\pi \times (1.5 \times 10^{11})^2}$ (1) Answer = 1 379 or 1 365 [W m^{-2}] (1)	1	1 1 1		4	3	
	(c)		Use of Wien's law to show surface emits λ_{peak} of 10 μm (accept 5 - 20 μm range) (1) Partially absorbed by water with reference to values from graph (1) Also absorbed by CO_2 with reference to values from graph (1) Re-emitted in all directions / towards surface [warming Earth] (1)			4	4	1	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)	**Any 2 × (1) from:** - U235 fissile whereas U238 is not (1) - Only small amount (0.7 %) of U235 in natural uranium (1) - U238 absorbs neutrons	2			2		
		(ii)	Use of $v = r\omega$ to obtain $\omega = 2\,333$ [rad s^{-1}] (1) 371 [rev s^{-1}] (1) Award 1 mark for answer of 186		2		2	2	
		(iii)	$0.7 \times 1.15^{n} = 5.0$ (1) n = 14.1 resulting in <u>15</u> stages required (1)		2		2	2	
			Question 10 total	**6**	**9**	**5**	**20**	**10**	**0**

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	1	6	3	10	5	0
2	6	0	0	6	1	6
3	4	9	3	16	9	0
4	6	9	3	18	7	0
5	2	5	11	18	12	18
6	5	7	0	12	7	0
7	6	9	5	20	10	0
8	6	9	5	20	10	0
9	6	9	5	20	10	0
10	6	9	5	20	10	0
TOTAL	**30**	**45**	**30**	**80**	**51**	**24**