GCE A LEVEL MARKING SCHEME

SUMMER 2018

A LEVEL
BIOLOGY - COMPONENT 3
A400U30-1

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INTRODUCTION

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was 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 conference was to ensure that the marking scheme was 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' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

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EDUQAS A LEVEL COMPONENT 3
REQUIREMENTS FOR LIFE

MARK SCHEME SUMMER 2018

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

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. Award the middle mark in the level if most of the content statements are given and the communication statement is partially met. Award the lower mark if only the content statements are matched.

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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

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		circulatory system/ flow of blood/ {deoxygenated blood brought to/ oxygen(ated blood) removed from } lungs (1) ventilation/ breathing/ exchanges air in the lungs/ inhale and exhale (1)	2			2		
		(ii)		paO_2 is {highest/ higher} at A/ blood is more oxygenated/ /blood in pulmonary vein has more oxygen than in pulmonary artery (1)		1		1		
		(iii)		**Any two (x1) from:** not enough time/ blood flow too fast (1) some O_2 used for respiration (1) references to cooperative binding with haemoglobin/ some haemoglobin is bound to carbon dioxide(1)		2		2		
		(iv)		**Any two (x1) from:** {hydrogen carbonate (ions) bicarbonate (ions) /HCO_3^- (ions)} (1) Carbaminohaemoglobin/ {combined with/ bound to} haemoglobin (1) carbonic acid/ H_2CO_3/ carbon dioxide dissolved in plasma (1)	2			2		
	(b)	(i)		spongy mesophyll	1			1		1
		(ii)		**Any three (x1) from:** A. mammals have a {ventilation system/circulatory system}/ ORA (1) B. plants rely on diffusion only (1) C. higher concentration gradient in mammals/lower in plants/ concentration gradient actively maintained in animals (1) D. mammals have a higher rate of respiration/ mammals are more active/ ORA (1) E. mammals are warm blooded so more kinetic energy/ORA (1)	1	2		3		
				Question 1 total	**6**	**5**	**0**	**11**		**1**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		D and E	1			1		
		(ii)		C and D		1		1		
		(iii)		B and F		1		1		
	(b)	(i)		603 = 3 marks If incorrect award 2 marks for 603.264 or [603.1858... if use π on calculator] If incorrect award 1 mark for sight of 3.142×0.0004^2 or 5.03×10^{-7} or 0.00000050272 [not used total cross section] $3.142 \times 0.0008^2 \times 1.2 \times 10^9$ or 2410 or 2412.7 or 2413 [not used radius as 0.0004]		3		3	3	
		(ii)		**Any four (x1) from:** A. low protein diet reduces {plasma protein/albumin} levels (1) B. {plasma proteins/albumin} reduce water potential of blood (1) C. (Lack of protein)water potential of plasma becomes higher (1) D. Decreases water potential gradient (1) E. so less <u>water</u> reabsorbed/ more <u>water</u> remains in tissue fluid/ <u>water</u> moves out of the blood into the tissue fluid (1) Accept blood in place of plasma Accept blood proteins in place of plasma proteins	3	1		4		
				Question 2 total	**4**	**6**	**0**	**10**	**3**	**0**

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<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>3</td><td>(a)</td><td>(i)</td><td></td><td>IV = gas supplied to roots (1) Reject concentration of gases
DV = concentration of phosphate (in culture solution) (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Any two (x1) from:
Factor + explanation = 1 mark
<table><tr><th>Factor</th><th>Explanation</th></tr><tr><td>temperature</td><td>Changes energy of particles/ changes metabolic activity/ rate of phosphate uptake/ rate of active transport/ rate of diffusion</td></tr><tr><td>volume of gas supplied/ rate of supply of gas</td><td>could change rate of respiration</td></tr><tr><td>{surface area/ length} of roots</td><td>change the {area/ length} for absorption</td></tr><tr><td>Light</td><td>Would change rate of photosynthesis</td></tr><tr><td>size of seedling/ leaf area/ number of seedlings/ age of seedling</td><td>changes requirement for PO_4^{3-}</td></tr><tr><td>Humidity/ wind speed</td><td>Changes rate of transpiration</td></tr><tr><td colspan="2">Reject: same volume of culture medium/ concentration of ions/ pH</td></tr></table></td><td></td><td></td><td>2</td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>absorption is highest with oxygen + indicates active transport (as this requires ATP) (1)
also occurs in absence of oxygen + indicates diffusion as this is not dependent on respiration/passive process (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>endodermis (1)</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>{Casparian strip/ suberin} {stops apoplast route/forces into symplast route/ have to pass across cell membrane} / (1)
active transport needed (to move ions into endodermal cell) (1)</td><td></td><td>1</td><td>1</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 3 total</td><td>1</td><td>5</td><td>3</td><td>9</td><td>0</td><td>5</td></tr>
</table>

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Accept range between (-) 31 to 31.43% = 2 marks If incorrect award 1 mark for (140µm – 96µm)/140µm x 100		1 1		2	2	
		(ii)		Both needed for **1 mark**: A = capillary B = lacteal/ lymph vessel/ lymphatic vessel	1			1		1
		(iii)		Any **two** (x1) from (Group 2) are not {eating/ absorbing lipids} (so don't need lacteals) (1) (cells in) both groups need blood to bring {oxygen/glucose} for {respiration/ ATP production}(1) lacteals remove substances but capillaries deliver as well as remove/ owtte (1)		2		2		
	(b)			longer to increase surface area/ larger number to increase surface area/ORA (1) thinner to decrease diffusion distance/ORA (1) Group 1 need to {digest food/absorb nutrients} (1)		2	1	3		
	(c)			*Answers relate to Group 1 – accept reverse arguments:* **mitochondria** ATP synthesis + {for active transport/enzyme production} (1) **single layer of cells** reduces distance for nutrients to pass into {capillaries/lacteals/ bloodstream}/ increase rate of absorption for uptake (1)	1	1		2		
	(d)			Burmese pythons can go without food for 1 year – 4 weeks not an issue (1) Killing/experiments on animals/no obvious benefit (1)			2	2		
				Question 4 total	**2**	**7**	**3**	**12**	**2**	**1**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		**Both answers** correct for **1 mark**: I A and B II A, C and D	1			1		
		(ii)		hamstring has more synapses/ ORA (1) hamstring has more neurones/ ORA(1) Accept use of data if comparative/ or descriptions of neurones involved in both reflex arcs		2		2		
	(b)			A. Sodium ion (gated) channels open (1) B. Sodium ions {rush in/influx} (1) NOT into membrane C. Threshold {reached/exceeded} (1) D. Charge changes to become positive inside axon and negative outside axon/ correct references to suitable values (-70 and + 40 mV) (with units)/ depolarisation (1) MPs A and B in context of ions (does not need to appear in both)	4			4		
	(c)	(i)		**Any two (x1) from:** testing (significance of) differences between {means/ sets of {continuous / normally distributed/ interval }}data(1) Chi squared used to test significance of differences in {discontinuous / nominal} data /can calculate expected value (1) T test there are no expected values/ chi squared has expected values (1)		2		2	2	
		(ii)		A. Critical value is 2.10 (1) NOT circled in table alone B. because t value is greater than critical value (at p=0.05)(1) C. reject null hypothesis (1) D. {results/ means } are significantly different(1) ECF MP b,c,d if incorrect critical value chosen			4	4	4	
				Question 5 total	**5**	**4**	**4**	**13**	**6**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		**Any two (x1) from:** cellulases (1) digest cellulose into β glucose (1) through hydrolysis/breaking of (β1,4) glycosidic bonds (1)		2		2		
		(ii)		more sugar reduces {solute potential/water potential} outside cells (1) water moves out of cells by osmosis (1)	1	1		2		
	(b)	(i)		Cellulase digests cell walls (1) Phospholipases digest {cell membrane / phospholipid bilayer} 1)		2		2		
		(ii)		**Any two (x1) from** A. xylem vessels (1) B. xylem: only carries water upwards / phloem: transport is bi-directional (1) C. If xylem: plants wilt above the point of infection/ phloem: so all parts affected (1)			2	2		
	(c)			**Any three (x1) from** A. Named human activity (e.g. combustion/ deforestation/ agriculture) which (1) B. increased {CO_2/ greenhouse gases} in atmosphere causing global warming (1) C. warmer climate in **south** of UK favours E. chrysanthemi (1) NOT UK unqualified D. not in Scotland yet as temperatures still too low (1)	1		2	3		
	(d)	(i)		contains DNA fragments of known {number of base pairs/length/size} (1) NOT sequence determine {number of base pairs/length/size} of DNA being analysed (1) NOT sequence	1	1		2		2
		(ii)		{3 / 4} (species) (1) S1 and S6 the same **+** S2 and S4 the same (1) NOT similar Unsure about S3 and S5 due to {blurring/indistinct bands}(1)			3	3		3
				Question 6 total	**3**	**6**	**7**	**16**	**0**	**5**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7.				**Indicative content** **Ecstasy** • ADH increases permeability of {DCT /collecting duct} to water • more aquaporins added into the cell membrane • more water reabsorbed (and lower volume of urine produced) • increases sweat production so reduces {urine volume/ water potential of plasma} **Furosemide** • ions transported out of ascending limb of Loop of Henle into tissue fluid of medulla • lower solute/water potential of tissue fluid/ creates a water potential gradient in medulla • Water moves out of {descending limb/ collecting duct} by osmosis • this reduces volume of {filtrate/ urine} • fewer ions into medulla reduces water potential gradient so less water reabsorbed from {descending limb/collecting duct} • {filtrate /urine} volume remain high **Hyponatraemia** • **ecstasy** causes increased body temperature – body reacts by sweating resulting in increased loss of Na^+ • **ecstasy** causes increased thirst – blood is diluted • **ecstasy** too much water reabsorbed dilutes the blood • (**furosemide** inhibits transport of Na^+ out of filtrate) so more Na^+ are passed out in urine • **furosemide** also increases urine volume so more Na^+ lost from body	3	3	3	9		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks A clear account of the role of the loop of Henle and ADH/collecting duct interaction is given. This is related in detail to the action of MDMA in increasing permeability of the collecting duct to water through the incorporation of more aquaporins and also how furosemide decreases the reabsorption of water by decreasing the water potential gradient between the filtrate and the tissue fluid in the medulla. A detailed explanation is given of how both drugs can lead to low blood Na^+ levels. *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately*. **4-6 marks** The involvement of the loop of Henle and the collecting duct, together with the role of ADH is described. The effects of MDMA and/or furosemide are linked to these structures and their effect on the volume of urine is explained. A sound attempt is made to explain how both drugs can result in hyponatraemia. *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.*						

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-3 marks The formation of urine is described and an attempt is made to relate the action of MDMA or furosemide to the changes in urine volume. A basic attempt is made to explain how one of these drugs can result in hyponatraemia. *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.*						
				Question 7 total	**3**	**3**	**3**	**9**		

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Option A Immunology and disease

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		Vector NOT carrier	1			1		
		(ii)		(Insect repellent/loose clothing/keeping windows closed and mosquito net) prevent mosquitoes biting (1) Not feeding (Avoiding stagnant water means) avoiding areas where mosquitoes breed (1) NOT hatching	2			2		
	(b)	(i)		**Any three (x1) from:** A. Viruses are not cellular so do not have metabolic pathways B. A vaccine would need to target {virus infected cells/ viruses directly when in tissue fluid/blood/outside cells} C. Viruses enter host cells so they avoid recognition by host immune system/drugs may not be able to get to virus D. Drugs would interfere with host cells metabolism or damage the host cells(1) E. Antigenic variation/ or description of/ drug resistance (1)		2	1	3		
		(ii)		Need **two** features for **1 mark** • Must be {safe/ not cause harm}/ not have side effects • must be effective/ trigger an immune response	1			1		
	(c)			Strategy **2** more effective in long term (1) **Any four (x1) from:** Number **1** • Advantage: Antibodies would act quickly/ confers immediate protection (1) • Placental transfer will protect the baby (1) • Disadvantage: no memory cells would be produced/ no long term immunity (1) Number **2** • Advantage: the production of memory cells (1) • Reference to herd immunity (1) • Disadvantage: would take longer to act (1)		1 1 1	1 1	5		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			Accept any value 34.5 - 43.9 = 2 marks If incorrect allow 1 mark for sight of Calculation 500/58 x **4** 500/58 x **5**		2		2	2	1
	(e)	(i)		Endemic: a disease, always present {at low levels (in an area)/ frequently at a predictable rate in a specific location/ population} (1) {Surgical patients – skin open to bacteria} / {Sick/elderly patients – low levels of immunity}/ ORA (1)	1	1		2		
		(ii)		{Inhibition of/ prevent/ stop} {protein synthesis/translation} (1) Humans have different ribosomes to bacteria (1)	1	1		2		
	(f)			**Any two (x1) from:** Not enough people (1) Only males (1) Only done on one ethnic group (1) Needs to be tested in infected individuals (1) Use of control group/placebo (1)			2	2		2
				Question 8 total	**6**	**9**	**5**	**20**	**2**	**3**

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Option B Human Musculoskeletal anatomy

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Transverse section		1		1		1
		(ii)		A – {I band/ Actin only} as it only contains thin filaments B – {H zone/ myosin only} as it contains thick filaments only C - outer edge/dark region of A band as it shows overlap of thick and {thin filaments/ actin and myosin} Accept labelled on diagram for location		3		3		
		(iii)		**Any 4 (x1) from:** A. Ca^{2+} ions bind to troponin changing its shape B. moves tropomyosin, exposing binding sites on actin (1) C. Myosin heads make cross bridges to actin by binding to these sites (1) D. ADP and Pi are released causing the myosin head to bend (1) E. ATP joins to myosin head breaking the cross bridge to actin(1) F. Actin filaments slide along myosin (by ratchet mechanism) (1)	4			4		
	(b)	(i)		Myofibril diameter could vary between individuals and within an individual in different muscles			1	1		1
		(ii)		less force generated)(1) Any **one** (x1) from In post-flight muscle the actin and myosin have bigger spaces between them Actin has been broken down/less actin {Fewer cross bridges can form/ less myosin bound to actin}		1	1	2		
	(c)	(i)		C because the patient is younger/ could be more active (1) D (has osteoporosis,) making new bone growth more difficult/ osteoblasts less active (1)			2	2		
		(ii)		Patient will be mobile more quickly **and** this promotes healing/ reduced complications with blood clots/pressure sores/ less muscle wastage/ DVT	1			1		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		Biceps – third order **and** Triceps – first order	1			1		
		(ii)		When bicep flexes **E**ffort is between **F**ulcrum and **L**oad/ effort in middle (1) When tricep flexes **F**ulcrum is between **L**oad and **E**ffort/ fulcrum in middle (1)		2		2		
		(iii)		Same length arms/age/type of exercise/gender			1	1		1
		(iv)		F = 25N = 2 marks If incorrect allow 1 mark for sight of $\frac{2.5 \times 50}{5}$ $F_1 \times 5 = 50 \times 2.5$		2		2	2	
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**3**

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Option C Neurobiology

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>10</td><td>(a)</td><td></td><td></td><td>Sensory homunculus shows relative sensitivity of different parts of the body and Motor homunculus shows the motor control of different parts of the body. (1)
Any three (x1) from
<table>
<tr><td>Area for hand is greater in the motor cortex</td><td>fine motor control (1)</td></tr>
<tr><td>Area for face is greater in motor cortex</td><td>because of the fine motor control needed for {facial expressions/ chewing/swallowing/ vocalisation (1)</td></tr>
<tr><td>Area devoted to tongue/lips/genitals greater in sensory cortex</td><td>due to large number of sensory receptors (1)</td></tr>
<tr><td>No area in motor cortex for teeth, gums, genitals</td><td>No motor control of teeth, gums, genitals (1)</td></tr>
</table></td><td>1</td><td>1
1
1</td><td></td><td>4</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>fMRI provides information on brain function + whereas MRI/CT scan provide images which show structure (1)
Any two (x1) from
• Neuroplasticity (1)
• Undamaged axons grow new nerve endings to connect damaged neurons (1)
• Recovery of function is associated with less (area of) brain activity, due to increasingly efficient neural circuitry (1)</td><td>1
1</td><td>1</td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>304 000 times greater = 2 marks
If incorrect award 1 mark for
1 900 000 x 60
114 000 000</td><td></td><td>2</td><td></td><td>2</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Left motor {cortex/ area} (1)
increasing brain activation seen on left side of cerebrum (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td></td><td>Stroke in Broca’s area – patient cannot produce speech (1)
Stroke in Wernicke’s area – patient does not understand speech (1)</td><td>1
1</td><td></td><td></td><td>2</td><td></td><td></td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Reduces aggression (1) Dominant males and females have {stronger/fitter} offspring, improving the survival/ advantageous alleles passed (1)		1 1		2		
		(ii)		Males fight for sexual access to females/ Sexual selection has favoured evolution of larger males.	1			1		
	(d)	(i)		They are used to being handled and show natural behaviour			1	1		
		(ii)		Positive (correlation)		1		1		1
		(iii)		Repeat investigation with more individuals/ with a different mob (1) Use data from individuals of the same age/same gender (1)			1 1	2		2
				Question 10 total	**6**	**9**	**5**	**20**	**2**	**3**

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COMPONENT 3 – A2 BIOLOGY EDUQAS

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Q	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	**6**	**5**	**0**	**11**	**0**	**1**
2	**4**	**6**	**0**	**10**	**3**	**0**
3	**1**	**5**	**3**	**9**	**0**	**5**
4	**2**	**7**	**3**	**12**	**2**	**1**
5	**5**	**4**	**4**	**13**	**6**	**0**
6	**3**	**6**	**7**	**16**	**0**	**5**
7	**3**	**3**	**3**	**9**	**0**	**0**
TOTAL	**24**	**36**	**20**	**80**	**11**	**13**
8	**6**	**9**	**5**	**20**	**2**	**3**
9	**6**	**9**	**5**	**20**	**2**	**3**
10	**6**	**9**	**5**	**20**	**2**	**3**
TOTAL	**30**	**45**	**25**	**100**	**13**	**16**
TARGET	**30**	**45**	**25**	**100**	**8**	**12**

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