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General Certificate of Education
June 2010

Applying Mathematics UOM4/1

Advanced Subsidiary Level

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Key to mark scheme and abbreviations used in marking

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation

√or ft or F	follow through from previous incorrect result	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	or equivalent	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
–*x* EE	deduct *x* marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded. However, there are situations in some units where part marks would be appropriate, particularly when similar techniques are involved. Your Principal Examiner will alert you to these and details will be provided on the mark scheme.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

General Certificate of Education

A/S Level - Applying Mathematics UOM 4/1

Answers and Marking Scheme – June 2010

Question 1

(a)	$\frac{1}{2^3} = \frac{1}{8}$ $3 \times 3.8 = 11.4$ days	**M1** **A1**	Some indication of 3 half-lives
(b)	$19/3.8 = 5$ $\left(\frac{1}{2}\right)^5 = \frac{1}{32}$	**M1** **A1ft**	Some indication of 5 half-lives or follow through from their (a) (0.03128) or as a percentage or follow through from (a)
	TOTAL	**4**	

Question 2

	$\frac{m_0}{2} = m_0\ \mathrm{e}^{-\lambda \times 3.8}$ $\frac{1}{2} = \mathrm{e}^{-\lambda \times 3.8}$ $\ln\frac{1}{2} = -0.6931 = -\lambda \times 3.8$ or $\mathrm{e}^{-\lambda} = (0.5)^{\frac{1}{3.8}}$ $\lambda = 0.182$	**M1** **M1** **A1**	or $2 = \mathrm{e}^{3.8\lambda}$ Correct statement without m_0 $\ln 2 = 3.8\lambda$ handling logs correctly must have both method marks
	TOTAL	**3**	

Question 3

(a)	$\frac{1}{2} = e^{-\lambda \times 24}$ $\ln\left(\frac{1}{2}\right) = -0.6931 = -\lambda \times 24$ $\lambda = 0.0289$	 **M1A1** **A1**	 using ln
(b)	$p^{24} = 0.5$ $\ln p^{24} = \ln(0.5)$ $24 \ln p = \ln 0.5$ $\ln p = -0.2888$ $p = 0.972$	**M1** **M1** **M1** **A1**	correct statement alternatively $p = \sqrt[24]{\frac{1}{2}}$ M2 Or 2nd alternative $(p =) e^{-0.02891 \times l}$ (M1) + M2 M2 dependent on M1 condone 0.971
	TOTAL	**7**	

Question 4

	Shorter Must refer to quantifiable factor eg may show half-life 1.39 days or refer to how much substance after a certain length of time or "λ is greater" or sketch graph.	**B1** **B1**	 dependant on first B1
	TOTAL	**2**	

Question 5

	$m_0 = 1$ $m_1 = 0.833$ $m_2 = 0.694$ $m_3 = 0.578$ $m_4 = 0.482$ $m_5 = 0.401$	**M1** **A1** **A1**	evidence of use of recurrence relation accurately (at least once) SC2 0.482
	TOTAL	**3**	

Question 6

	$p^n = 0.6^n = \frac{1}{2}$ $\ln(0.6)^n = \ln\left(\frac{1}{2}\right)$ $n \ln(0.6) = \ln\left(\frac{1}{2}\right)$ $n = \frac{\ln\left(\frac{1}{2}\right)}{\ln 0.6} = 1.357 = 1.36$ 1.357 days = 24 × 1.357 = 32.56 hours 33 hours (1 day 8.56 hours = 1 day 9 hours)	**M1** **M1** **A1** **M1** **A1ft**	using logs correctly with $P1 = \frac{1}{2}$ correct law of logs $(n \times 24)$ From their n
	TOTAL	**5**	

Question 7

(a)	See table on next page		
(b)	The probability would suggest $N = 12$ The value in the simulation is lower because more of the random numbers are 0,1,2,3, than might be expected (but that's randomness!)	**B1** **B1**	Quantifying Alternatively 7 atoms out of 20 suggests $P = 0.35$ must mention randomness/predictability or sample size
	TOTAL	**6**	
	TOTAL MARK FOR PAPER	**30**	

1, 2, 3 = atom decaying 4, 5, 6, 7, 8, 9 = atom not decaying

atom	t=0	t=1		t=2		t=3		t=4		t=5		t=6	
	status	random no	status	random no	status	random no	status	random no	status	random no	status	random no	status
A	1	2	0										
B	1	5	1	1	0								
C	1	2	0										
D	1	0	0										
E	1	3	0										
F	1	9	1	9	1	3	0						
G	1	3	0										
H	1	4	1	1	0								
I	1	1	0										
J	1	5	1	7	1	8	1	9	1	1	0		
K	1	0	0										
L	1	3	0										
M	1	3	0										
N	1	2	0										
O	1	3	0										
P	1	9	1	2	0								
Q	1	3	0										
R	1	0	0										
S	1	9	1	8	1	2	0						
T	1	4	1	4	1	4	1	3	0				
total	20		7		4		2		1		0		

for t = 3, B1 for correct random nos.
for t = 4, B1ft for status of their random nos and renewing atoms.
for t = 5, B1ft for status of their random nos. and renewing atoms
B1ft for correct total row (their columns added correctly).

} 4 marks in total only