Level 3 Certificate

Mathematics

H868/01: Introduction to Quantitative Reasoning

OCR Level 3 Certificate Core Maths A (MEI)

Mark Scheme for June 2022

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

    YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
    Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions
Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate). *When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.*

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space

   Award Zero '0' if:
   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response: Not applicable in F501
       a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
       b. **To determine the mark within the level**, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations and abbreviations**

Annotation in scoris	Meaning
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme	Meaning
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

12. **Subject-specific Marking Instructions**

a   Annotations should be used whenever appropriate during your marking.

       The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

       For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

b   An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct *solutions* leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

       Correct but unfamiliar or unexpected methods are often signalled by a correct result following an *apparently* incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

c   The following types of marks are available.

       M
       A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

       A
       Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

       B
       Mark for a correct result or statement independent of Method marks.

E
A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

d   When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

e   The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only — differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

f   Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise. Candidates are expected to give numerical answers to an appropriate degree of accuracy, with 3 significant figures often being the norm. Small variations in the degree of accuracy to which an answer is given (e.g. 2 or 4 significant figures where 3 is expected) should not normally be penalised, while answers which are grossly over- or under-specified should normally result in the loss of a mark. The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.

g   Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

NB Follow these maths-specific instructions rather than those in the assessor handbook.

h   For a *genuine* misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A mark in the question.

Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

i   Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

Question		Answer	Mks	Guidance	AO
1	(a)(i)	$20 \times 5.5(0)$	M1		1
		$= £110$	A1	_____ Total of just 1 for 110 with "£" omitted	1
			[2]		
1	(a)(ii)	0.375 p per mile or £0.00375 per mile Or 2.66 … or 2.67 miles per p Or 266. … or 267 miles per £	B2	Division and full units, no explicit comparison necessary. Condone "1 mile (is/=/:) 0.375 p" oe "1£ (is/=/:) 266. … miles" oe	3
		_____ **or** _____	**or**	_____ **or** _____	
		Any of: 0.375 0.00375 2.66 … 2.67 2.7 266. … 267 270	B1	Evidence of appropriate division and assuming either of the two rates are applied.	3
		_____ **or** _____	**or**	_____ **or** _____	
		80 miles according to the article should cost $80 \times 0.01 = £0.80$ or 80p	B1	oe	3
		But full charge cost £0.30 or 30p, so the article is wrong	B1	Dependent on first B1	3
			[2]		

1	(a)(iii)	Cost of electricity for a month = 200 × 0.375 = 75 (p) or A month (200 miles) needs 200 ÷ 80 = 2.5 @ 30p a charge gives 75(p) So a saving of 110 – *their* 0.75 = (£)109.25 ((£)109.10 if rounded to 3 charges)	**B1** **B1**	Follow through on *their* working days in a month (can be implied from (a)(i)) Condone rounding of 2.5 charges to 3 giving cost of 3 × 30 = 90(p) Allow follow through on *their* £110 _____ Condone for 2 "£"110 iff explicit statement to neglect electricity costs.	2 2
			[2]		

1	(a)(iv)			The "yes" may be implied – need not be explicitly stated, think conversational English. Condone sensible rounding at any point. There may be some other hybrid methods, so may have "to pick and mix" but avoid double counting.	
		In a year Mia will cycle $350 \times 12 = 4200$ (miles)	M1		2
		So for 4 years $4 \times 4200 = 16\,800$ (miles)	A1		2
		Which will need $16800 \div 80 = 210$ charges, so yes or 1000 charges will be enough for 80 000 (miles)	B1	Follow through on *their* 16800 oe Or any other equivalent methods	3
		_____ or _____	or	_____ or _____	
		In a year 4200 miles	M1		2
		which is $4200 \div 80 = 52.5$ (or 52 or 53) charges	A1		2
		So enough for $1000 \div 52.5 = $ about 19 years	B1		3
		_____ or _____	or	_____ or _____	
		$1000 \times 80 = 80\,000$ (miles)	M1		2
		$80\,000 \div 350 = 228.57 \dots$ (months)	A1		2
		$= 19$ years,	B1		3
			[3]		

1	(b)			Full follow through throughout on *their* 75p (monthly re-charging cost), including any incorrect re-working. e.g. from starting from first principles by number of charges per month × 30p and possibly rounding this at any point.	1
		Total outgoings a month excluding loan = Helmet etc. + electricity = (£)20 + *their* 75p ((£)20.75 / (£)20.90)	**B1**	Allow throughout 90p or 75p the former from rounding 2.5 charges to 3 (see (a)(iii)	2
		Maximum payment (cost of bus per month) = (£)110	**B1**	Seen or implied, follow through on *their* £110 from (a)(i)	2
		(To keep to Mia's rule, maximum repayment on loan is) *their* (£) 110 – (£)20 – *their* 75p= (£) 89.25 /(£)89.10 or (£)73.13 + (£)20 + *their* 75p = (£)93.88 / (£)94.03 (which is less than *their* (£)110)	**B1**		3
		So can only buy the Electric Blue (at £800 loan repayments £73.13 pm)	**B1**	Dependent on 3 B1 __ **Electricity cost** __ SC4 If *their* 75p electricity charge is omitted but iff note made to omit it as small and the following is correct then can gain full credit. If missing but no comment then 1 for (£)110 – (£)20 = (£)90 or (£)73.13 + (£)20 (following through on *their* £110) 1 for Electric Blue (dependent on the first mark) Allow monthly mileage of 350 from previous question giving (350/80)×30 = £1.31)	
			[4]		

| 2 | (a)(i) | 110 (waves) | **B1** | | 1 |

			[1]		
	(a)(ii)	Differences – any one of: - North Atlantic wave heights are more spread out (or vice versa for Gulf of Mexico) oe North Atlantic waves are on average higher (or vice versa for Gulf of Mexico) oe More waves greater than 2m in the Gulf oe More waves less 4 m in the Gulf oe	**B1**	Allow other sensible and relevant responses. Do not accept statements concerning means – unless evidence of calculation: North Atlantic mean ≈ 4 m Gulf of Mexico mean ≈ 3 m.	3
		Similarities – any one of: - Both are not symmetrical or skewed to the right oe Both have a modal range of (2 to 4) metres oe Neither are Normal oe	**B1**	Allow other sensible and relevant responses	3
			[2]		
2	**(b)(i)**	(The modal interval is) 4 (m) $\leq w < 8$ (m)	**B1**	Condone "4 to 8"	1
			[1]		
2	**(b)(ii)**	(The median is between) the 150(th) and 151(st) result (which is the interval 4 (m) $\leq w < 8$ (m))	**B1**	Condone reference to only the 150th point iff evidence of $55 + 97 = 152$ oe	3
			[1]		
2	**(b)(iii)**	=D2*E2 or =E2*D2	**B1**	Must be "*" Allow =$E2*$D2 oe (also only $ on one) and =(E2)*(D2) oe	1
			[1]		

2	(c)	Mean wave height = 2480 ÷ 300	**M1**		1
		= 8.26 …	**A1**	Accept mean wavelength 8.3 or 8.267 and 8.26 ….. all seem reasonable giving these acceptable final answers 33.1, 33, 33.(066 ….)	1
		4 × 8.26 .. = 33. (066 …) m	**B1**	1 for 4 × *their* 8.26 … correct but *their* 8.26 … must be the result of an obviously attempted calculation. Truncated of rounded.	2
			[3]		

3	(a)(i)		**B1**	Point (76, 27) clearly indicated within ± ½ a small division.	1
			[1]		

3	(a)(ii)		**B1**	Use overlay, line laying within region and extending at least from 20% to 70% The tram lines for *their* line are (0, 2) to (80, 28) and (0, -2) to (80, 24). Must be a ruler drawn	1
			[1]		

3	(a)(iii)	50(%) (of leaves have smooth edges)	**B1**	Soi	2
		(Reading off from scatter graph, 50% smooth edged is a temperature of) 17 (°C)	**B1**	Follow through on *their* line of best fit (15°C to 18°C), may not necessarily be stated overtly.	2
		(Which is) warmer (than the present temperature)	**B1**	Follow through on *their* found and stated temperature. Condone "its double the temperature" or …°C compared with …°C" oe. Condone "different" Accept alternative route based on working back from the 7.6°C. Following through on *their* straight line. 1 for (22 to 26)(%) (% for 7.6°C) 1 for 50 – (22 to 26) = (28 to 24) or comment to effect that the previous % figure is less than 50(%) 1 last B1 above (the conclusion)	2
			[3]		

3	(b)	Dinosaur extinction range 65.91 to 65.99 (million years ago) oe or lowest is 65.91 (million years ago) oe	B1		3
3		Dinosaur bone age 64.4 to 66.2 (million years ago) oe or highest is 66.2 (million years ago) oe	B1		3
				If B0, B0 then SC1 for at least two of these seen: 65.91, 65.99, 64.4 or 66.2 Condone cavalier use of < and ≤ etc.	
3		There is overlap between the two ranges, so yes dinosaur bone age is consistent oe the dinosaur bone could be from before extinction oe	B1	Follow through on *their* stated ranges. Condone "yes" or "no" if supported by *their* stated bands.	3
			[3]		

4	(a)(i)	$(2r)^2 - \pi r^2$ $= 4r^2 - \pi r^2$	**B1**	Must be "better than" $(2r)^2 - \pi r^2$ e.g. $r^2 (4 - \pi)$ is sufficient isw after "$4r^2 - \pi r^2$"	1
			[1]		
4	(a)(ii)	$\left(\dfrac{\left(4r^2 - \pi r^2\right)}{4r^2}\right) \times 100$ 3 $= \left(\dfrac{\left(4 - \pi\right)}{4}\right) \times 100$ $= (100 - 25\pi)\,(\%)$	**M1** **A1**	1 for $\left(\dfrac{their\ \left(4r^2 - \pi r^2\right)}{4r^2}\right) \times 100$ 1 is for the partial simplification of the correct expression. Just this final step on its own with no previous working gains no credit. If a numerical approach adopted then SC1 for **calculation** of percentage via the formula of 21.(46 …)(%) compared with calculated percentage via the actual **calculated areas** also of 21.(46 …)(%) - comparison must be the result of two calculations. Condone sensible rounding at any point.	3 3
			[2]		

4	(b)	(Area of an irrigation circle =) π (400)^2	M1	May be implied	1
		$= 502654. \dots \dots$	A1	Condone accurately rounded answers	1
		$= 500\,000$ (m^2)	B1	Follow through on correctly rounding *their* 502 654. …. Condone for full credit effectively just the answer (Assume working from calculator display).	3
			[3]		
4	(c)	$100 \times 100 \times 0.1 = 1000$ cm^3 (= (1 litre) oe)	B1		3
			[1]		
4	(d)	$500\,000$ (litres) ÷1000	B1	Full follow through on *their* 500 000 or 502654. …. …(m^2) i.e, their unrounded figure	2
		$= 500$ (m^3)	B1		3
			[2]		
4	(e)	500×11	M1	Full follow through on $11 \times$ *their* 500 soi	3
		$= 5\,500$ (m^3)	A1		2
		_____ or _____	**or**	_____ **or** _____	
3		Area of circular field $\times$ 0.011 $= 500\,000 \times 0.011$	M1	Use *their* area of circular field	3
		$== 5\,500$ (m^3)	A1		3
			[2]		

5	(a)(i)	$(\text{mean speed}) = \dfrac{3600 \times 1}{12.08}$	M1	Allow lack of "×1"	1
		$= 298.013(245\ldots)$ (mph)	A1	Can imply M1 from 298 or better	1
			[2]		
5	(a)(ii)	$= (\textit{their } 298.013 \ldots + 304.311) \div 2$	B1	Soi	2
		So, no, mean of the two runs = $(304.311 + \textit{their } 298.013) \div 2 = 301.162 \ldots$ (mph)	B1	Follow through on *their* 298.013 ... A comment is required here, "no" at an absolute minimum.	2
			[2]		
5	(b)(i)	60 (m s⁻¹)	B1		1
			[1]		
5	(b)(ii)	(The graph is) not a straight line	B1	Oe (e.g. "curved")	3
		so not constant acceleration	B1	Dependent on previous mark. Accept for full credit responses like "No it's a curve" oe as a bare minimum. SC1 "accelerates more after 6 seconds" or "acceleration speeds up"	3
			[2]		

5	(b)(iii)	20	B1	These are independent marks so the correct units for acceleration attached to their number gains the second B1.	2
		$m\,s^{-2}$	B1	Or equivalent mps^2 (but not m/s^{-2} etc.)	2
			[2]		
5	(c)	$1000 = \dfrac{3600 \times 1}{T}$	M1	Soi	1
		$T = 3.6$ seconds	A1		1
			[2]		
5	(d)	1 small square = 400 (m) or 0.4 (km) or 1 large square = 2 km	B1	May be implied by correct answer. Condone "4 squares = 1 mile" oe Or "4 squares = 1.6 km" oe	2
		Length of track = 20 (km)	B1	_____ Allow for just 1(with correct units) in the inclusive range 12 to 13 miles	2
			[2]		

6	(a)(i)	5.27 (Zloty)	**B1**		1
			[1]		
	(a)(ii)	6 (days)	**B1**		2
			[1]		
	(a)(iii)	20(th April)	**B1**		2
			[1]		
	(b)(i)	5.27×1000	**M1**		2
		= 5270	**A1**		2
			[2]		
	(b)(ii)	$5270 \div 5.44$	**M1**	1 for *their* $5270 \div 5.44$	2
		= 968.75	**A1**	No follow through	2
		$1000 - 968.75 = (£)\ 31.25$ (loss)	**B1**	1 for $1000 - $ *their* 968.75 (loss / gain as appropriate).	2
			[3]		

7	(a)	$4.7 \ldots$ (or 4.8) $\times 10^9$ oe	B1	Allow answer for the first B1 of 4 761 904 762	2
				Follow through correct rounding on *their* 4.7 ..... $\times 10^9$	
		5×10^9 (Mt) (1 sf)	B1	correct answer implies first mark. (Demand is for "standard form to 1 significant figure".)	2
			[2]		
7	(b)(i)	2017 WT28	B1	Condone 2017 or WT28	3
			[1]		

| 7 | (b)(ii) | *For example:-*
With 2007 DX40: (diameter) ÷ (impact energy) = 40 ÷ 3.9 = 10.2 …
With 2012 QD8: (diameter) ÷ (impact energy) = 80 ÷ 48 = 1.6 …

No, because (diameter) ÷ (impact energy) should be the same for all the NEOs | **B1**

B 1

E1 | 1 for any correct calculation
(diameter) ÷ (impact energy) or vice versa

Condone follow through on *their* two calculations
_____
Allow (diameter) ÷ (impact energy)
or (impact energy) ÷ (diameter)
1 for 1 correct division
Or
2 for 2 correct comparable divisions | 3

3

3 |
| | | | | | |

Table (within mark scheme):

NEO	2007 DX4	2012 QD8	2017 WT28	1950 DA
Diam.	40	80	8	1600
Engy.	3.9	48	0.013	10000
D ÷ E	10.2 …	1.6 …	615.3 …	0.16 …
E ÷ D	0.097...	0.6 …	0.0016...	6.25 …

		_____ **or** _____ Radii of 2007 DX20 and 2012 QD8 are 40 and 80, one is double the other So, the impact energy of 2012 QD8 should be 2 × 3.90 = 7.8 it is not, it is 48, so statement not true	**or** **B1** **B1** **E1**	_____ **or** _____ Award similarly for 80 and 8 or 40 and 8 The E1 mark needs something along the lines given – the correct calculations and a "no" gains this mark. _____ or _____ SC1 ordered list sorted on energy or diameter and "increase" together (but no reference to "proportionality").	3 3 3
			[3]		
7	(b)(iii)	(Torino scale/number) 1	**B1**	Condone if correct point only, indicated unambiguously.	3

			[1]			
7	(c)	0.000 01	**B1**	Condone 10^{-5}		3
			[1]			
7	(d)	$\left(\dfrac{\pi \times 1.01 \times 10^5 \times 0.95^3}{3} \approx \right) \dfrac{3 \times 1 \times 10^5 \times 1^3}{3} = 10^5$ or 100 000	**B1**	1 for showing two of these approximations explicitly. $\dfrac{\pi}{3} \approx 1 \qquad 1.01 \approx 1 \qquad (0.95)^3 \approx 1$ Condone if these are obviously submitted into the expression i.e. $\dfrac{3 \times 1 \times 10^5 \times 1^3}{3}$		1
			B1	Correct answer (10^5 or 100 000 oe)		2
			[2]			

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