GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS – NUMERACY
UNIT 1 – HIGHER TIER
3310U50-1

INTRODUCTION

This marking scheme was used by WJEC for the 2023 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.

Unit 1: Higher Tier	Mark	Comments
1. (Mari's share of the prize) 4 × 2700 ÷ (4 + 5) OR (Huw's share of the prize) 5 × 2700 ÷ (4 + 5)	M1	(4 × 300) (5 × 300)
(Mari's share is £) 1200	A1	Allow for sight of (£)1200 irrespective of the name assigned May be implied in later calculation (Huw's share is £1500)
(Mari donates) 0.24 × 1200	M1	FT 0.24 × 'their smaller share' (Note: 'their smaller share' < 1350)
(£) 288	A1	
(Fraction of his prize Huw donates) $\dfrac{0.24 \times 1200}{5 \times 2700 \div (4 + 5)}$ or $\dfrac{0.24 \times 1200}{2700 - 1200}$ or $\dfrac{288}{1500}$ or $1 - \dfrac{(1500 - 0.24 \times 1200)}{2700 - 1200}$ or $1 - \dfrac{1212}{1500}$	M1	FT 'their 0.24 × 'their smaller share'' and 2700 – 'their smaller share'
$\dfrac{24}{125}$	A1	Must be a simplified fraction, ISW (e.g. 19.2%) An unsimplified fraction (144/750 or 96/500 or 72/375 or 48/250) is awarded M1 A0 Only FT if there are at least 2 different common prime factors for the numerator and denominator for simplifying, and not both numerator and denominator being a multiple of 10, i.e. equivalent level of difficulty If consistently working with Mari's getting the larger share, initially possible M1, A1 or M1, A0, but then M0, A0, M0, A0. However, also award SC2 for a final answer of $^3/_{10}$ or SC1 for (donation) (£)360. Mari with larger share leads to: $\dfrac{0.24 \times 1500}{2700 - 1500} = \dfrac{360}{1200} = \dfrac{3}{10}$

1. _Alternative method:_ _(Fraction of his prize Huw donates)_ $\frac{4}{5} \times \frac{24}{100}$	M3	_M2 for sight of ⅘ of 24%_ _M1 for sight of ⅘ of 24_
$\frac{24}{125}$	A3	_Must be a simplified fraction_ _A2 for correct unsimplified fraction, e.g._ $\frac{96}{500}$ _Only FT if there are at least 2 different common prime factors for the numerator and denominator for simplifying, i.e. equivalent level of difficulty_ _ISW (e.g. 19.2%)_
Organisation and communication	OC1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanations and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means
Writing	W1	For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc.
2(a) 1 : 100 000	B1	
2(b)(i) 1 500 000 ÷ (2 × 60)	M2	With no other further working May be shown in stages M1 for any one of the following, that may be embedded in further incorrect working: • 1 500 000 ÷ 2 (or 750 000) • 1 500 000 ÷ 60 (or 25 000)
12500 (litres/min)	A1	CAO
2(b)(ii) Sight of 30 000 (cm) AND 1 500 000 000 (cm³)	B1	Or two values of the correct comparative order, not for 1 500 000 and 300
1 500 000 000 ÷ 30 000 or equivalent	M1	For the intention of this division, allow with place value error (including 1 500 000 ÷ 300) for M1 only
50 000 (cm²)	A1	CAO. ISW if sight of answer 50 000 **cm²**

3(a) (Sugar $0.58 \times 300 =$)   174 (g)
    (Cocoa $300 \div 8 =$)   37.5 (g)
 	
  (Milk powder) $4 \times 37.5 \div 5$
                                 $(=) 30$ (g)
 	
 (Palm oil $300 - 174 - 37.5 - 30 =$)   58.5 (g)
OR
(Ingredients other than palm oil $174 + 37.5 + 30 =$)
                                       241.5 (g)
 	
(% of Palm oil) $(100 \times)\dfrac{58.5}{300}$ or $58.5 \div 3$ or 0.195
 	
or $(100 \times) 1 - \dfrac{241.5}{300}$ or $1 - 0.805$ or equivalent
 	
                                    19.5 (%)
	B1
	B1
	
	M1
	A1
	
	B1
	
	M1
	
	A1
		
		FT 'their derived mass of cocoa'
		
		May be implied in further working
		FT correctly evaluated sum of 'their sugar, cocoa and milk' provided at least 2 marks previously awarded and this sum is < 300
		
		FT 'their 58.5' or 'their 241.5' as appropriate
		
		CAO, must be given as a percentage

3(a) Alternative method 1:
 (Cocoa) ⅛ $\times 100$ or $1 \div 8$
                  12.5 % or 0.125
(Milk powder) ⁴/₅ $\times$ ⅛ $(\times 100)$
 	
                10 % or 0.1
 	
(Other than palm oil)   *(58 + 12.5 + 10 =) 80.5 %*
            or (0.58 + 0.125 + 0.1 =) 0.805
 	
(Palm oil)   *100 – (58 + 12.5 + 10)*
         or 1 – (0.58 + 0.125 + 0.1) or 0.195
 	
                   19.5 (%)
	M1
	A1
	M1
	
	A1
	
	B1
	
	M1
	
	A1
		
		FT 'their 12.5% or 0.125' or 'their % or decimal mass of cocoa'
		
		May be implied in further working
		FT 58 + 'their 12.5 + 10' or 0.58 + 'their 0.125 + 0.1' correctly evaluated provided at least 2 marks previously awarded and this sum is < 100 or < 1 respectively
		
		FT 58 + 'their sum of %s cocoa and milk' or equivalent working with decimals
		
		CAO, must be given as a percentage

3(a) Alternative method 2:
(Proportion other than palm oil)
$\frac{58}{100} + \frac{1}{8} + \frac{4}{5} \times \frac{1}{8}$ *or* $\frac{58}{100} + \frac{1}{8} + \frac{1}{10}$
                       $\frac{805}{1000}$ *or* $\frac{161}{200}$
 	
(Palm oil) $1 - {}^{161}/_{200}$ or ${}^{39}/_{200}$ or ${}^{19.5}/_{100}$
 	
                   19.5 (%)
	M3
	
	A1
	
	M2
	
	A1
		
		May be implied in further working
		
		FT from M3
		
		CAO, must be given as a percentage

3(b) Realising that 840g is 120% For appropriate use of 120% being 840g, e.g. $840 \div 1.2$ or $8400 \div 12$ or $100 \times 840/120$ 700 (g)	B1 M1 A1	 Also implies previous B1 Award all 3 marks for an answer of 700(g) provided not from incorrect working

4(a) 40 (seconds)	B1	
4(b) 0.9 × 60 or 60 − 0.1 × 60 = 54 (employees) In 60 seconds, 57 employees logged on or 54 employees logged on within 58 seconds	M1 A1 B1	Penalise incorrect units -1 only. Ignore additional spurious statements Check the diagram for indication, provided values are written FT 'their 54 employees' provided M1 previously awarded and number of seconds < 60

4(b) *Alternative method 1:*
By 1 minute, 57 employees logged on
 	
  (100 ×) 57/60
               0.95 or 95(%)
                   or
    570/600 compared with (90% =) 540/600
	B1
	
	M1
	A1
		Penalise incorrect units -1 only.
		
		If M0, A0 award SC1 for 'only 5% (or 0.05) not logged on'
		
		If no marks, award SC1 for an answer of 93(.3..)% or 96(.6..)% or rounded to 97% or equivalents as decimals from use of 56 or 58 respectively

4(b) *Alternative method 2:* *For **clearly** considering employees not logged on, must be evidence of this before awarding marks* *(0.1 × 60 =) 6 (employees not logged on)* *(After 9:01 a.m.) 60 − 57* *3 (employees not logged on)*	 *B1* *M1* *A1*	*Penalise incorrect units -1 only.* *If M0A0, award SC1 for an answer of 4 or 2 employees from sight of calculation 60 - 56 or 60 - 58*
4(b) *Alternative method 3:* *For **clearly** considering employees not logged on, must be evidence of this before awarding marks* *(0.1 × 60 =) 6 (employees not logged on)* *(For 6 employees not logged on graph gives)* *58 seconds* *Conclusion that after 58 seconds there are fewer than 6 employees not logged (i.e. more than 90% logged on)*	 *B1* *M1* *A1*	*Penalise incorrect units -1 only.* *FT 'their 6 employees'' provided 0.1 × 60 attempted and 'their 58 seconds' < 60*

5(a)　　　At a randomly chosen name	B1	
5(b)　(360 ÷ 6 =) 60 　or　　360 ÷ 60 = 6　　or　　6 × 60 = 360	B1	May be implied by any of the following: • consistent position patterns + 60 indicated for at least 3 consecutive positions 　　e.g.　(4,) 60, 120, 180, 240, 300 • sight of 64 for student 2
<table><tr><td>1st</td><td>2nd</td><td>3rd</td><td>4th</td><td>5th</td><td>6th</td></tr><tr><td>4</td><td>64</td><td>124</td><td>184</td><td>244</td><td>304</td></tr></table>	B1	CAO
6(a) Correct format of a box-and-whisker	B1	Do not ignore additional lines drawn End stopper lines omitted can be ignored For unambiguous indications of the following:
Showing lower end whisker at 10 seconds	B1	On the graph paper. Allow for the least point indicated
Showing LQ　40 seconds	B1	On the graph paper. Must be the lower line of a rectangle
Showing　　　median at　84 seconds 　　AND　　　　UQ at 108 seconds 　　AND greatest time 130 seconds	B1	On the graph paper Median and UQ must be unambiguous vertical lines, allow 130 indicated as a point or a vertical line
6(b)　　6 seconds	B1	
6(c) 0.75 × 200 or equivalent 　　　　　　　　　　　　　150 (phone calls)	M1 A1	Allow sight of '75% of 200' or '³⁄₄ of 200' Answer space takes precedence If no marks, award SC1 for an answer of 50 (phone calls)
7(a)(i) (Least possible volume of a carton =) 　　　　　　　40 × 12.5 　　　　　　　　　　　　= 500 (cm³)	M1 A1	Allow use of 12 ≤ h < 13 for M1 only CAO If no marks awarded, SC1 for use of 12.5
7(a)(ii) Use of 8500 　　　　　　$\frac{8500}{500}$　(× 60) 　　　　　　　　　　　= 1020	B1 M1 A1	Allow 8499.999(…) for 8500 FT 'their 500' from (a)(i) If B0, FT provided unambiguously chosen: 8000 < 'their 8500' ≤ 9000 CAO for 'their 500' from (a)(i)

7(b)
 (length^2 =) 960 ÷ 20
  length^2 = 48   OR   (length =) √48
 	
  (length =) 4√3
	M1
	A1
	
	B2
		Or equivalent e.g. $\sqrt{4} \times \sqrt{12}$
		
		Mark final answer
		Accept 40√3 mm, but not 0.04√3 m
		
		For B2, FT 'their derived 48' provided of equivalent difficulty (it has a square number as one of its factors)
		
		For B1, FT 'their derived 48'
		B1 for writing 48 as a product of 2 or more factors where one of the factors OR the product of 2 of their factors is a square number
		e.g. 16 × 3 or 4 × 4 × 3 or 4 × 12 or 2 × 2 × 12 OR
		B1 for writing $\sqrt{48}$ as a product of 2 or more factors where one of the factors OR the product of 2 of their factors <u>gives</u> a whole number
		e.g. $\sqrt{16} \times \sqrt{3}$ or $\sqrt{2} \times \sqrt{2} \times \sqrt{12}$ or $2\sqrt{12}$

8(a)
  $\dfrac{1000}{2\times10^{-24}}$ OR $\dfrac{1000}{1.5\times10^{-24}}$ OR $\dfrac{1000}{1.6\times10^{-24}}$
 	
= 5 × 10^{26} OR 6.6(66…) × 10^{26} OR 6.25 × 10^{26}
  or 6.7 × 10^{26} or 6.3 × 10^{26}
  or   7 × 10^{26} or 6 × 10^{26}
	M1
	
	A2
		Or equivalents
		
		A1 for equivalent values but not in standard form
		e.g. 500 × 10^{24} or 0.5 × 10^{27} or their equivalent ordinary numbers

*8(a) <u>Alternative method:</u>
  $\dfrac{1020}{1.7\times10^{-24}}$*
 	
  = 6 × 10^{26}
	M1
	
	A2
		Allow M1 for 1000/1.7×10^{-24} provided their answer has a leading digit of 6
		
		A1 for equivalent value but not in standard form e.g. 600 × 10^{24} or 0.6 × 10^{27} or the equivalent ordinary number
		
		If M0A0, award SC1 for an answer of 5.8(…)× 10^{26} or 5.9 × 10^{26} from 1000/1.7×10^{-24}

8(b)
 	
  2×(1.7 × 10^{-24}) + (2.7 × 10^{-23})   or equivalent
  = 3.04 × 10^{-23} (g)
	
	M1
	A2
		If a candidate adds the mass of 2 atoms of oxygen and 1 atom of hydrogen, treat as a misread
		(Answer will be 5.57× 10^{-23})
		
		A1 for the equivalent of 3.04 × 10^{-23} but not in standard form
		e.g. 30.4 × 10^{-24} or the equivalent ordinary number, OR
		A1 for 3 × 10^{-23}
		
		If no marks, award SC1 for an answer of 2.87 × 10^{-23} (using one atom of hydrogen)

9(a) $\dfrac{2}{3} \times \pi \times radius^3 = \dfrac{128\pi}{3}$ or equivalent	M1	
$radius^3 = \dfrac{128\pi \times 3}{2 \times \pi \times 3}$ or equivalent OR $radius = \sqrt[3]{\dfrac{128\pi \times 3}{2 \times \pi \times 3}}$ or equivalent	M1	For isolating $radius^3$ FT if the volume of a sphere used for a possible M1A1 only
(radius =) 4 (cm)	A2	CAO A1 for $radius^3 = 64$ or (radius =) $\sqrt[3]{64}$ OR A1 for $radius^3 = 32$ or (radius =) $\sqrt[3]{32}$ if the volume of a sphere used
(Surface area =) $2 \times \pi \times 4^2$	M1	FT 'their 4' provided an attempt made to use the formula for the volume of a sphere to calculate the radius
$= 32\pi$ (cm²)	A1	Accept 3200π mm² or 0.0032π m² If 'their radius = $\sqrt[3]{32}$' then their SA will be $2^{13/3}\pi$ If final M0A0, award SC1 for $4 \times \pi \times$ 'their r^2' evaluated correctly provided an attempt made to use the formula for the volume of a sphere to calculate the radius
9(b) $\sqrt[3]{8} : \sqrt[3]{27}$ or $\sqrt[3]{8 \div 27}$ or $\sqrt[3]{27 \div 8}$ (= 2 : 3) (= 2/3) (= 3/2)	B1	May be implied in further working
(Height =) $18 \times \dfrac{2}{3}$ or $18 \div \dfrac{3}{2}$ or equivalent	M1	Implies previous B1 provided not from incorrect working FT 'their 2/3' or 'their 3/2' provided first B1 awarded
= 12 (cm)	A1	CAO Note: 27 ÷ 18 = 1.5 followed by either 18 ÷ 1.5 = 12 or 8 × 1.5 = 12 is awarded B0M0A0

10(a)(i) ½ × 40 × 20 = 400 (m)	M1 A1	
10(a)(ii) (time at 20 m/s =) $\dfrac{16000 - 400 - 0.5 \times 80 \times 20}{20}$ OR $\dfrac{16000 - 400 - 2 \times 400}{20}$ $\left(= \dfrac{14800}{20}\right)$ = 740 (seconds) (Total journey time = 740 + 40 + 80 =) 860 (seconds)	M3 A1 B1	FT 'their 400' from (a)(i) M2 for one of: • $400 + 20 \times (\text{time at 20m/s}) + \dfrac{1}{2} \times 80 \times 20 = 16000$ • $400 + 20 \times (\text{time at 20m/s}) + 2 \times 400 = 16000$ • $16000 - 400 - 0.5 \times 80 \times 20$ (= 14800) • $16000 - 400 - 2 \times 400$ (= 14800) M1 for one of: • $1/2 \times 80 \times 20$ (= 800) • 2×400 (= 800) • $400 + 20 \times (\text{time at 20m/s}) + \ldots = 16000$ or equivalent ISW. FT 'their 740' provided at least M2 previously awarded
10(a)(ii) Alternative method 1: *$\dfrac{1}{2}((\text{time at 20}) + 120 + (\text{time at 20})) \times 20 = 16000$* *(time at 20m/s =) $\dfrac{16000 \times 2 - 2400}{40}$ or equivalent* *(=29600/40)* *= 740 (seconds)* *(Total journey time = 740 + 40 + 80 =) 860 (seconds)*	*M2* *m1* *A1* *B1*	*FT 'their 400' from (a)(i)* *Or equivalent* *e.g. only considering the journey from t=40* *$\dfrac{1}{2}((\text{time at 20}) + 80 + (\text{time at 20})) \times 20 = 16000 - 400$* *M1 for one of:* • *$\dfrac{1}{2}((\text{time at 20}) + 120 + (\text{time at 20})) \times 20$* • *$\dfrac{1}{2}((\text{time at 20}) + 80 + (\text{time at 20})) \times 20$* *For isolating (time at 20 m/s)* *FT 'their 740' provided at least M1 previously awarded*
10(a)(ii) Alternative method 2: *$\dfrac{1}{2}((\text{total time}) + (\text{total time}) - 120) \times 20 = 16000$* *(total time =) $\dfrac{16000 \times 2 + 2400}{40}$ or equivalent* *(=34400/40)* *= 860 (seconds)*	*M3* *m1* *A1*	*Or equivalent e.g.* *$400 + 20(\text{total time} - 120) + (20 \times 80)/2 = 16000$* *M2 for* • *$\dfrac{1}{2}((\text{total time}) + (\text{total time}) - 120) \times 20$ or* • *$400 + 20(\text{total time} - 120) + (20 \times 80)/2$*

10(b) e.g. $10x = 10.8181…$ and $1000x = 1081.8181…$ or equivalent AND an attempt to subtract	M1	Allow $10x = 0.8181…$ and $1000x = 81.8181…$
$(x =) \underline{1071}$ or $\underline{108171}$ or $1\frac{81}{990}$ or equivalent $\quad\quad\quad 990 \quad\quad 99990$	A1	Accept e.g. $\underline{107.1}$ or $\underline{10817.1}$ $\quad\quad\quad\quad 99 \quad\quad\quad 9999$ Allow e.g. $\underline{8.1}$ or $\underline{81}$ or $\underline{8181}$ $\quad\quad\quad\quad\quad 99 \quad 990 \quad 99990$
$(x =) 1\frac{9}{110}$	A1	FT 'their $\underline{1071}$' provided of equivalent difficulty $\quad\quad\quad\quad\quad 990$
11. (Volume of octagonal prism =) $50 \times 20 \;+\; 2 \times \underline{1} \times (50 + 20) \times ((50 - 20)/2)$ or $\quad\quad\quad\quad\quad\quad 2$ $\quad\quad 50 \times 20 \;+\; 2 \times \underline{1} \times 70 \times 15$ $\quad\quad\quad\quad\quad\quad\quad\quad 2$ $\quad\quad\quad (= 1000 \;+\; 1050)$	M2	May be embedded within a volume calculation 50×20 may be seen as $20 \times 20 + 2 \times 20 \times ((50 - 20)/2)$ $\quad\quad\quad\quad\quad\quad\quad\quad$ or $20 \times 20 + 2 \times 20 \times 15$ $2 \times \underline{1} \times (50 + 20) \times ((50 - 20)/2)$ may be seen as $\quad\quad 2$ $2 \times (20 \times ((50 - 20)/2) + 2 \times \underline{1} \times (50–20)/2 \times (50–20)/2)$ or $\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 2$ $\quad\quad\quad 2 \times (20 \times 15 + 2 \times \underline{1} \times 15 \times 15)$ $\quad\quad\quad\quad\quad\quad\quad\quad\quad 2$ M1 for $50 \times 20 \;+\; \underline{1} \times (50 + 20) \times ((50 - 20)/2)$ or $\quad\quad\quad\quad\quad\quad\quad 2$ M1 for $50 \times 20 \;+\; \underline{1} \times 70 \times 15$ OR $\quad\quad\quad\quad\quad\quad\quad 2$ M1 for ……… $+\; 2 \times \underline{1} \times (50 + 20) \times ((50 - 20)/2)$ or $\quad\quad\quad\quad\quad\quad\quad\quad 2$ M1 for ……… $+\; 2 \times \underline{1} \times 70 \times 15$ $\quad\quad\quad\quad\quad\quad\quad\quad 2$
$\quad\quad\quad\quad\quad\quad \times 5 \times 10$	m1	FT from M1
$\quad\quad\quad\quad\quad\quad\quad = 102\,500 \;(cm^3)$	A1	CAO If M0m0A0 awarded, and from an incorrect assumption that the octagon is regular, award SC1 for areas of: • $8 \times (20 \times 25)/2 = 2000$ (possibly leading to a volume of 100 000) or • $50^2 – 20^2 = 2100$ (possibly leading to a volume of 105 000)
(Volume of a cone =) $\underline{1} \times 800 \times 60$ $\quad\quad\quad\quad\quad\quad\quad 3$	M1	Award M1A0 if this is multiplied by 10
$\quad\quad\quad\quad\quad\quad\quad = 16\,000 \;(cm^3)$	A1	CAO
(Total volume = $102\,500 + 16\,000$ =) $\quad 118\,500 \;(cm^3)$	B1	FT 'their $102\,500$' and 'their $16\,000$' provided at least one M1 mark awarded and is the sum of the volumes of their 10 octagonal bases and 1 (or 10) cone/s
11. Alternative method for the first 4 marks: *(Volume of octagonal prism =)* *$50^2 – 4 \times \underline{1} \times (50 – 20)/2 \times (50 – 20)/2$ or* *$\quad\quad\quad 2$* *$\quad\quad 50^2 – 4 \times \underline{1} \times 15 \times 15$* *$\quad\quad\quad\quad\quad\quad\quad 2$* *$\quad\quad\quad (= 2500 – 450)$*	*M2*	*May be embedded within a volume calculation* *M1 for … $– 4 \times \underline{1} \times (50 – 20)/2 \times (50 – 20)/2$ or* *$\quad\quad\quad\quad\quad\quad 2$* *M1 for … $– 4 \times \underline{1} \times 15 \times 15$* *$\quad\quad\quad\quad\quad\quad 2$*
$\quad\quad\quad\quad \times 5 \times 10$	*m1*	*FT from M1*
$\quad\quad\quad\quad\quad = 102\,500 \;(cm^3)$	*A1*	*CAO*