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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer		Mark
1(a)	**Max 1 of** • <u>Vernier</u> calipers • <u>Digital</u> calipers • Micrometer (screw gauge)	(1) (1) (1)	1
1(b)	**Max 1 of** • The 20.0 mm measurement is an outlier / anomaly (accept measurement 3) • The student misread the scale for the 20.0 mm measurement • The cube is not uniform • The cube has been damaged	(1) (1) (1) (1)	1
1(c)	• Use of uncertainty = half of the range (0.1 mm) **Or** use of uncertainty = max difference from mean • Percentage uncertainty = 0.5% rounded to 1 or 2 s.f. <u>Example of calculation</u> Uncertainty = (20.3 mm – 20.1 mm) / 2 = 0.1 mm Percentage uncertainty = (0.1 mm / 20.2 mm) × 100% = 0.5%	(1) (1)	2
1(d)(i)	• Converts mm to m **and** g to kg • Use of volume = length × width × height • Use of density = mass / volume • Density = 8830 (kg m^{-3}) <u>Example of calculation</u> Volume = length × width × height Volume = 0.0202 m × 0.0203 m × 0.0201 m = 8.24×10^{-6} m^3 Density = mass / volume Density = 0.0728 kg / 8.24×10^{-6} m^3 = 8834.95 kg m^{-3}	(1) (1) (1) (1)	4
1(d)(ii)	**EITHER** • Calculates 2% range of uncertainty in density • Calculates upper and lower limits of density values • Metal is copper as it has a density within the range MP3 dependent on MP2 **OR** • Calculates percentage difference between density from 1(d)(i) and table value • ... for all three metals • Metal is copper as it has a percentage difference < 2% MP3 dependent on MP2 Allow ecf for the use of 8800 kg m^{-3} or their value from (d)(i) <u>Example of calculation</u> Upper limit = 8833 kg m^{-3} × 1.02 = 9010 kg m^{-3} Lower limit = 8833 kg m^{-3} × 0.98 = 8656 kg m^{-3} OR Percentage difference = ((8940 kg m^{-3} – 8830 kg m^{-3}) / 8830 kg m^{-3}) × 100% Percentage difference =1.25%	(1) (1) (1) (1) (1) (1)	3
	Total for question 1		**11**