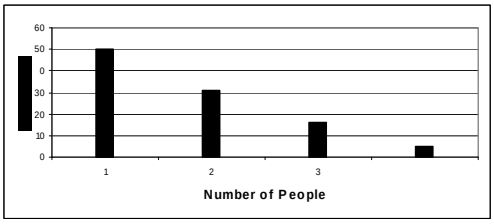
Question			Answer	Marks	Guidance	
1	(i)		Positive **[1]**		CAO	
1	(ii)		Mean = 5.064 allow 5.1 with working 126.6/25 or 5.06 without SD = 1.324 allow 1.3 with working or 1.32 without **[3]**	B1 B2	Allow B1 for RMSD = 1.297 or var =1.753 or MSD = 1.683	Also allow B1 for Sxx = 42.08 or for $\Sigma x^2 = 683$ SC1 for both mean = 50.64 and SD = 13.24 (even if over-specified)
1	(iii)		$\bar{x} - 2s = 5.064 - 2\times1.324 = 2.416$ $\bar{x} + 2s = 5.064 + 2\times1.324 = 7.712$ So there is an outlier. **[4]**	B1FT M1 A1FT E1	FT their mean and sd for $\bar{x} + 2s$ but withhold final E mark if their limits mean that there are no outliers. For upper limit Incorrect statement such as 7.6 and 8.1 are outliers gets E0 Do not award E1 if calculation error in upper limit	For use of quartiles and IQR $Q_1 = 3.95$; $Q_3 = 6.0$; IQR = 2.05 3.95 – 1.5(2.05) gets M1 Allow other sensible definitions of quartiles 6.0 + 1.5(2.05) gets M1 Limits 0.875 and 9.075 So there are no outliers NB do not penalise over-specification here as not the final answer but just used for comparison. FT from SC1

Question			Answer	Marks	Guidance	Additional Guidance
2	(i)		0 | 8 8 10 | 5 5 20 | 5 6 9 30 | 1 1 4 4 6 Key 20 | 9 represents 29 degrees Celsius	G1 G1 G1 G1 **[4]**	Stem **(in either order)** Leaves Sorted and aligned **(use paper test if unsure)** Key	Do not allow leaves 25 ,26, 29 etc Ignore commas between leaves (indep). Condone 1 error or omission Allow errors in leaves if sorted Condone missing units (Celsius) Allow stem 0, 1, 2, 3
	(ii)		Median = 27.5	B1 **[1]**		**CAO**
	(iii)		The median since the mean is affected by the skewness of the distribution	B1 E1 **[2]**	For median Allow **E2 for** mean if supported by very convincing reason **EG takes all values into account and no extreme values**	Do not allow 'less affected by extremes or outliers' unless also mention (**positive or negative)** skewness. Condone 'bottom half more spread' or similar

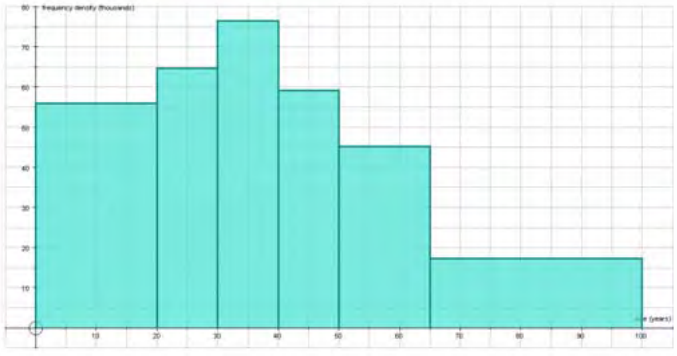
3 **(i)**	Mode = 960 (grams) Median = 1020 (grams) N.B. 96 and 102 gets SC1	B1 CAO B1 CAO	**2**	Ignore units and working
(ii)	Positive	E1	**1**	Not right skewed Not positive correlation
		TOTAL	**3**	

4	**(i)**	5 | 2 6 | 3 4 7 8 7 | 1 2 2 3 5 5 9 8 | 1 Key 6 | 3 represents 63 mph	G1 stem G1 leaves CAO G1 sorted G1 key	**[4]**
	(ii)	Median = 72 Midrange = 66.5	B1 FT B1 CAO	**[2]**
	(iii)	*EITHER:* Median since midrange is affected by outlier (52) *OR:* Median since the lack of symmetry renders the midrange less representative	E1 for median E1 for explanation **TOTAL**	**[2]** **[8]**

5 (i)	Median = 2 Mode = 1	B1 CAO B1 CAO	**2**
(ii)		S1 labelled linear scales on both axes H1 heights	**2**
(iii)	Positive	B1	**1**
		TOTAL	**5**

6 (i)	(With $\sum fx = 7500$ and $\sum f = 10000$ then arriving at the mean) (i) £0.75 scores (B1, B1) (ii) 75p scores (B1, B1) (iii) 0.75p scores (B1, B0) (incorrect units) (iv) £75 scores (B1, B0) (incorrect units) **After B0, B0** then sight of $\frac{7500}{10000}$ scores SC1. SC1or an answer in the range £0.74 - £0.76 or 74p – 76p (both inclusive) scores SC1 (units essential to gain this mark) Standard Deviation: (CARE NEEDED here with close proximity of answers) • 50.2(0) using divisor 9999 scores B2 (50.20148921) • 50.198 (= 50.2) using divisor 10000 scores B1(*rmsd*) • If divisor is not shown (or calc used) and only an answer of 50.2 (i.e. not coming from 50.198) is seen then award B2 on b.o.d. (default) **After B0 scored** then an attempt at S_{xx} as evident by either $S_{xx} = (5000 + 200000 + 25000000) - \frac{7500^2}{10000}$ (= 25199375) or $S_{xx} = (5000 + 200000 + 25000000) - 10000(0.75)^2$ **scores (M1) or M1ft 'their 7500^2' or 'their 0.75^2'** NB The structure must be correct in both above cases with a max of 1 slip only after applying the f.t.	B1 for numerical mean (0.75 or 75 seen) B1dep for correct units attached B2 correct s.d. (B1) correct rmsd (B2) default $\sum fx^2 = 25{,}205{,}000$ **Beware** $\sum x^2 = 25,010,100$ **After B0** scored then (M1) or M1f.t. for attempt at S_{xx} *NB full marks for correct results from recommended method which is use of calculator functions*	**4**

(ii)	P(Two £10 or two £100) $= \frac{50}{10000} \times \frac{49}{9999} + \frac{20}{10000} \times \frac{19}{9999}$ $= 0.0000245 + 0.0000038$ $= (0.00002450245 + 0.00000380038)$ $= 0.000028(3)$ o.e. $= (0.00002830283)$ After M0, M0 then $\frac{\mathbf{50}}{\mathbf{10000}} \times \frac{\mathbf{50}}{\mathbf{10000}} + \frac{\mathbf{20}}{\mathbf{10000}} \times \frac{\mathbf{20}}{\mathbf{10000}}$ o.e. Scores SC1 (ignore final answer but SC1 may be implied by sight of 2.9×10^{-5} o.e.) Similarly, $\frac{\mathbf{50}}{\mathbf{10000}} \times \frac{\mathbf{49}}{\mathbf{10000}} + \frac{\mathbf{20}}{\mathbf{10000}} \times \frac{\mathbf{19}}{\mathbf{10000}}$ scores SC1	M1 for either correct product seen (ignore any multipliers) M1 sum of both correct (ignore any multipliers) A1 CAO (as opposite with no rounding) (SC1 case #1) (SC1 case #2) **CARE** answer is also 2.83×10^{-5}	**3**
		TOTAL	**7**

7 (i)	Positive	B1	**1**
(ii)	Number of people = 20×33 (000) + 5×58 (000) = 660 (000) + 290 (000) = 950 000	M1 first term M1(indep) second term A1 cao NB answer of 950 scores M2A0	**3**
(iii)	(*A*) *a* = 1810 + 340 = 2150 (*B*) Median = age of 1 385 (000th) person or 1385.5 (000) Age 30, cf = 1 240 (000); age 40, cf = 1 810 (000) Estimate median = (30) + $\frac{\mathbf{145}}{\mathbf{570}} \times \mathbf{10}$ Median = 32.5 years (32.54...) If no working shown then 32.54 or better is needed to gain the M1A1. If 32.5 seen with **no previous working** allow SC1	M1 for sum A1 cao 2150 or 2150 thousand but not 215000 B1 for 1 385 (000) or 1385.5 M1 for attempt to interpolate $\frac{\mathbf{145}k}{\mathbf{570}k} \times 10$ (2.54 or better suggests this) A1 cao min 1dp	**2** **3**
(iv)	Frequency densities: 56, 65, 77, 59, 45, 17 *(accept 45.33 and 17.43 for 45 and 17)* 	B1 for any one correct B1 for all correct (soi by listing or from histogram) **Note: all G marks below *dep* on attempt at frequency density, NOT frequency** G1 Linear scales on both axes (no inequalities) G1 Heights FT their listed fds or all must be correct. **Also widths. All blocks joined** G1 Appropriate label for vertical scale eg 'Frequency density (thousands)', 'frequency (thousands) per 10 years', 'thousands of people per 10 years'. (allow key). **OR f.d.**	**5**

(v)	Any two suitable comments such as: Outer London has a greater proportion (or %) of people under 20 (or almost equal proportion) The modal group in Inner London is 20-30 but in Outer London it is 30-40 Outer London has a greater proportion (14%) of aged 65+ **<u>All</u>** populations in **<u>each</u>** age group are higher in Outer London Outer London has a more evenly spread distribution or balanced distribution (ages) o.e.	E1 E1	**2**
(vi)	Mean increase ↑ median unchanged (-) midrange increase ↑ standard deviation increase ↑ interquartile range unchanged. (-)	Any one correct B1 Any two correct B2 Any three correct B3 All **five** correct B4	**4**
		TOTAL	**20**