Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
1	X ~ females $X \sim \text{N}(165, 9^2)$, Y ~ males $Y \sim \text{N}(178, 10^2)$	**M1**	3.3	5th Calculate probabilities for the standard normal distribution using a calculator.
	$\text{P}(X > 177) = \text{P}(Z > 1.33)$ (or = 0.0912)	**M1**	1.1b	
	$\text{P}(Y > 190) = \text{P}(Z > 1.20)$ (or = 0.1151)	**A1**	1.1b	
	Therefore the females are relatively taller.	**A1**	2.2a	
				(4 marks)
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
2a	$\text{P}(M < 850) = 0.3085$ (using calculator)	**B1**	1.1b	5th Calculate probabilities for the standard normal distribution using a calculator.
		(1)		
2b	$\text{P}(M < a) = 0.1$ and $\text{P}(M < b) = 0.9$	**M1**	3.1b	5th Calculate probabilities for the standard normal distribution using a calculator.
	(using calculator) $a = 772$ g	**A1**	1.1b	
	$b = 1028$ g	**A1**	1.1b	
		(3)		
				(4 marks)
Notes				

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Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
3	$X \sim B(200, 0.54)$	**B1**	3.3	7th Use the normal distribution to approximate a binomial distribution.
	$Y \sim N(108, 49.68)$	**B2**	3.1b	
	$P(X > 100) = P(X \geqslant 101)$	**M1**	3.4	
	$= P\left(Z \geqslant \dfrac{100.5 - 108}{\sqrt{49.68}}\right)$	**M1**	1.1b	
	$= P(Z \geqslant -1.06...) = 0.8554$	**A1**	1.1b	
				(6 marks)

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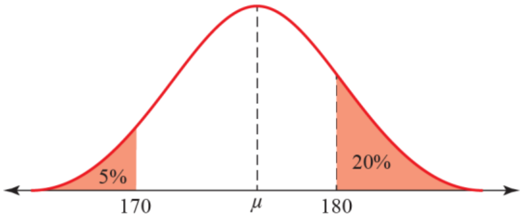
Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
4a	 bell shaped	**B1**	1.2	5th Understand the basic features of the normal distribution including parameters, shape and notation.
	170, 180 on axis	**B1**	1.1b	
	5% and 20%	**B1**	1.1b	
		(3)		
4b	P(X < 170) = 0.05	**M1**	3.3	7th Find unknown means and/or standard deviations for normal distributions.
	$\frac{170-\mu}{\sigma} = -1.6449$	**B1**	3.4	
	$\mu = 170 + 1.6449\sigma$	**B1**	1.1b	
	P(X > 180) = 0.2	**B1**	3.4	
	$\mu = 180 - 0.8416\sigma$	**M1**	1.1b	
	Solving simultaneously gives:	**A1**	1.1b	
	μ = 176.615… (awrt 176.6) and σ = 4.021…(awrt 4.02)	**A1**	1.1b	
		(7)		
4c	P(All three are taller than 175 cm) = $0.656\ldots^3$	**M1**	1.1b	5th Understand informally the link to probability distributions.
	= 0.282… (using calculator) awrt 0.282	**A1**	1.1b	
		(2)		
				(12 marks)

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Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
5a	n is large	**B1**	1.2	5th Understand the binomial distribution (and its notation) and its use as a model.
	p is close to 0.5	**B1**	1.2	
		(2)		
5b	Mean = np	**B1**	1.2	5th Understand the binomial distribution (and its notation) and its use as a model.
	Variance = $np(1-p)$	**B1**	1.2	
		(2)		
5c	There would be no batteries left.	**B1**	2.4	5th Select and critique a sampling technique in a given context.
		(1)		
5d	H_0: $p = 0.55$ H_1: $p > 0.55$	**B1**	2.5	5th Carry out 1-tail tests for the binomial distribution.
		(1)		
5e	$X \sim N(165, 74.25)$ $P(X \geqslant 183.5)$ $= P\left(Z \geqslant \frac{183.5-165}{\sqrt{74.25}}\right)$ $= P(Z \geqslant 2.146...)$ $=1 - 0.9838$ $= 0.0159$ Reject H_0, it is in the critical region. There is evidence to support the manufacturer's claim.	**B1** **M1** **M1** **A1** **A1** **M1** **A1**	3.3 3.4 1.1b 1.1b 1.1b 1.1b 2.2b	7th Interpret the results of a hypothesis test for the mean of a normal distribution.
		(7)		
				(13 marks)

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Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
6a	Bell shaped.	**B1**	2.2a	5th Understand the basic features of the normal distribution including parameters, shape and notation.
		(1)		
6b	X ~ Daily mean pressure $X \sim N(1006, 4.4^2)$	**M1**	3.3	5th Calculate probabilities for the standard normal distribution using a calculator.
	$P(X < 1000) = 0.0863$	**A1**	1.1b	
		(2)		
6c	A sensible reason. For example, The tails of a Normal distribution are infinite. Cannot rule out extreme events.	**B1**	2.4	5th Understand the basic features of the normal distribution including parameters, shape and notation.
		(1)		

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6d	Comparison and sensible comment on means. For example, The mean daily mean pressure for Beijing is less than Jacksonville. This suggests better weather in Jacksonville. Comparison and sensible comment on standard deviations. For example, The standard deviation for Beijing is greater than that for Jacksonville. This suggests more consistent weather in Jacksonville. Student claim could be correct.	**B1** **B1** **B1** **B1**	2.2b 2.2b 2.2b 2.2b	8th Solve real-life problems in context using probability distributions.
		(4)		
				(8 marks)

Notes

6a

Do not accept symmetrical with no discription of the shape.

6d

B2 for Suggests better weather in Jacksonville but less consistent.

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Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
7a	X ~ women's body temperature $X \sim N(36.73, 0.1482)$	M1	3.3	5th Calculate probabilities for the standard normal distribution using a calculator.
	$P(X > 38.1) = 0.000186$	B1	1.1b	
		(2)		
7b	Sensible reason. For example, Call the doctor as very unlikely the temperature would be so high.	B1	2.2a	8th Solve real-life problems in context using probability distributions.
		(1)		
				(3 marks)

Notes

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