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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| 1 | *X* ~ females *X* ~ N(165, 92), *Y* ~ males *Y* ~ N(178, 102) | M1 | 3.3 | 5thCalculate probabilities for the standard normal distribution using a calculator. |
| P(*X* >177) = P(*Z* >1.33) (or = 0.0912)  | M1 | 1.1b |
| P(*Y* >190) = P(*Z* > 1.20) (or = 0.1151) | A1 | 1.1b |
| Therefore the females are relatively taller. | A1 | 2.2a |
| (4 marks) |
| Notes |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **2a** | P(*M* < 850) = 0.3085 (using calculator) | **B1** | 1.1b | 5thCalculate probabilities for the standard normal distribution using a calculator. |
|  | **(1)** |  |  |
| **2b** | P(*M* < *a*) = 0.1 and P(*M* < *b*) = 0.9 | **M1** | 3.1b | 5thCalculate 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* ~ B(200, 0.54) | **B1** | 3.3 | 7thUse the normal distribution to approximate a binomial distribution. |
| *Y* ~ N(108, 49.68) | **B2** | 3.1b |
| P(*X* > 100) = P(*X* ⩾ 101) | **M1** | 3.4 |
| = P | **M1** | 1.1b |
| = P(Z ⩾ −1.06...) = 0.8554 | **A1** | 1.1b |
| (6 marks) |
| Notes |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **4a** | bell shaped | **B1** | 1.2 | 5thUnderstand 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*μ* = 170 + 1.6449*σ*P(*X* > 180) = 0.2*μ* = 180 − 0.8416*σ*Solving simultaneously gives:*μ* = 176.615… (awrt 176.6) and *σ* = 4.021…(awrt 4.02) | **M1****B1****B1****B1****M1****A1****A1** | 3.33.41.1b3.41.1b1.1b1.1b | 7thFind unknown means and/or standard deviations for normal distributions. |
|  | **(7)** |  |  |
| **4c** | P(All three are taller than 175 cm) = 0.656…3 | **M1** | 1.1b | 5thUnderstand informally the link to probability distributions. |
| = 0.282… (using calculator) awrt 0.282 | **A1** | 1.1b |
|  | **(2)** |  |  |
| (12 marks) |
| Notes |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **5a** | *n* is large | **B1** | 1.2 | 5thUnderstand 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 | 5thUnderstand 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 | 5thSelect and critique a sampling technique in a given context. |
|  | **(1)** |  |  |
| **5d** | H0: *p* = 0.55 H1: *p* > 0.55 | **B1** | 2.5 | 5thCarry out 1-tail tests for the binomial distribution. |
|  | **(1)** |  |  |
| **5e** | *X* ~ N(165, 74.25)P(*X* ⩾ 183.5)= P= P(*Z* ⩾ 2.146...)=1 − 0.9838= 0.0159Reject H0, it is in the critical region.There is evidence to support the manufacturer's claim. | **B1****M1****M1****A1****A1****M1****A1** | 3.33.41.1b1.1b1.1b1.1b2.2b | 7thInterpret the results of a hypothesis test for the mean of a normal distribution. |
|  | **(7)** |  |  |
| (13 marks) |
| Notes |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **6a** | Bell shaped. | **B1** | 2.2a | 5thUnderstand the basic features of the normal distribution including parameters, shape and notation. |
|  | **(1)** |  |  |
| **6b** | *X* ~ Daily mean pressure *X* ~ N(1006, 4.42) | **M1** | 3.3 | 5thCalculate 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 | 5thUnderstand 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** | 2.2b2.2b2.2b2.2b | 8thSolve real-life problems in context using probability distributions. |
|  | **(4)** |  |  |
| (8 marks) |
| Notes6aDo not accept symmetrical with no discription of the shape.6dB2 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* ~ N(36.73, 0.1482) | **M1** | 3.3 | 5thCalculate 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 | 8thSolve real-life problems in context using probability distributions. |
|  | **(1)** |  |  |
| (3 marks) |
| Notes |