**Name of the Student**:_____
**Max. Marks : 22 Marks** **Time : 22 Minutes**

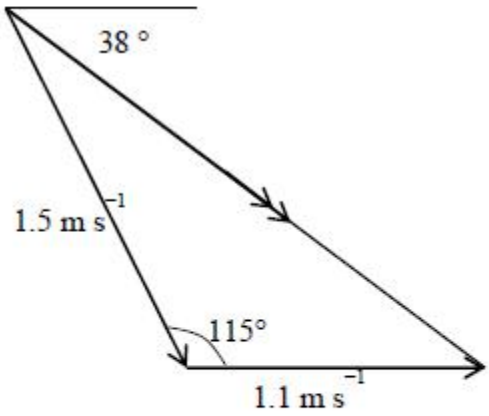
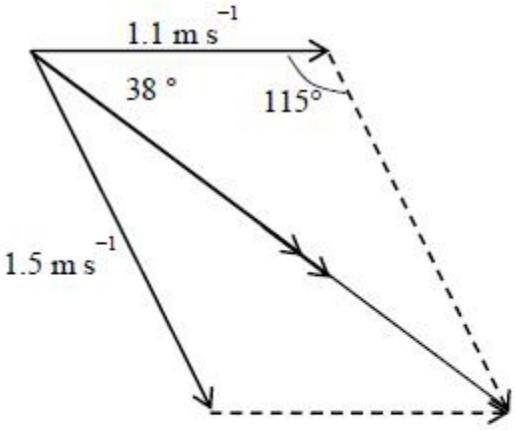
Mark Schemes

**Q1.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| (i) | • Use of $v = \frac{2\pi r}{T}$ or $\omega = \frac{2\pi}{T}$ (1)<br>• Use of $a = \frac{v^2}{r}$ or $r\omega^2$ (1)<br>• $a = 8.8\ \text{m s}^{-2}$ (1) | Example of calculation<br>$v = \frac{2\pi 6800000\text{m}}{92\times 60\text{s}} = 7740\ \text{m s}^{-1}$<br>$a = \frac{7740^2(\text{m s}^{-1})^2}{6800000\ \text{m}} = 8.81\ \text{m s}^{-2}$<br>or $\omega = \frac{2\pi}{92\times 60\ \text{s}} = 1.14\times 10^{-3}\ \text{rad s}^{-1}$<br>$a = 6800000\ \text{m} \times (1.14\times 10^{-3}\ \text{rad s}^{-1})^2$<br>$a = 8.81\ \text{m s}^{-2}$ | 3 |
| (ii) | • The astronauts have weight or not weightless (1)<br>**Or** Earth's gravitational field = 8.8 N kg$^{-1}$ on ISS (ECF from (b)(i))<br>• Earth's gravitational field keeps astronauts/ISS in circular motion (1)<br>**Or** Weight provides the centripetal force<br>• Our notion of "weight" is reaction force acting on us from the ground/floor (1)<br>• There are no reaction forces from the ISS on the astronauts so they "feel" weightless (1) | | 4 |

**Q2.**

| Question Number | Answer | | Mark |
|---|---|---|---|
| (a) | Use of pythagoras **Or** trigonometry to find the resultant velocity | (1) | |
| | $v = 1.9\ \text{m s}^{-1}$ | (1) | |
| | Use of trig to find the direction | (1) | |
| | Direction = 54° | (1) | **4** |
| | <u>Example of calculations</u> | | |
| | $v = \sqrt{(1.1\ \text{m s}^{-1})^2 + (1.5\ \text{m s}^{-1})^2}$ | | |
| | $v = 1.86\ \text{m s}^{-1}$ | | |
| | $\text{Direction} = \tan^{-1}\frac{1.5\ \text{m s}^{-1}}{1.1\ \text{m s}^{-1}}$ | | |
| | Direction = 53.74 ° | | |

| | | |
|---|---|---|
| (b) | Construction of a correct vector triangle or parallelogram (from which a measurement for the resultant could be made) **(1)**<br><br>$v = 2.2 \pm 0.1$ m s$^{-1}$ **(1)**<br><br>Direction = 38 ± 2° **(1)**<br><br>(Correct answers calculated mathematically rather than with a vector diagram will only score MP2 and MP3)<br><br>  <br>  | **3** |
| | **Total for question** | **7** |

**Q3.**

| Question number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| (i) | • Use of ½ $mv^2 = mgh$ **(1)**<br>• $v = 2.43$ m s$^{-1}$ **(1)** | Example of calculation:<br>$v = \sqrt{2gh} = \sqrt{2 \times 9.81 \times 0.30} = 2.43$ m s$^{-1}$ | **2** |
| (ii) | • Use of impulse = change in momentum **(1)**<br>• Recognises initial velocity is zero **(1)**<br>• Hence $F = 0.923$ N **(1)**<br>• Use of $l = \pi d$ **(1)**<br>• Equates calculated value of $F$ with $BIl$ **(1)**<br>• Hence I = 191 A **(1)** | Example of calculation:<br>$Ft = mv - mu$ where $u = 0$<br>So $F = (0.019$ kg $\times 2.43$ m s$^{-1})/0.05$ s $= 0.923$ N<br>$l = \pi \times 0.048$ m $= 0.151$ m<br>$I = 0.923$ N$/(0.032$ T $\times 0.151$ m$) = 191$ A | **6** |