

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

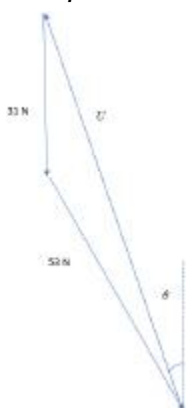
- (a) Closed triangle of forces drawn ✓

Appropriate scale ✓

$\theta = 23$ to 27 ($^\circ$) ✓

$U = 77$ to 81 (N) ✓

Accept scale where 10 N is represented by at least 1 cm.



Treat each marking point independently.

Do not accept answers for U and θ without a scale diagram.

Maximum of 3 marks for a free-body diagram where forces have been drawn to scale. (Check figure 8)

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- (b) V is vertical / Force at **Y** is now vertical / V does not have a horizontal component / $V = S + 31$ / V is perpendicular to the pole / V is of greater magnitude than U / Force at **Y** has increased in magnitude ✓

(Because) S and weight (or mg) are both vertical (in **Fig 3**) ✓

(Because) greater moment of weight (about **Y**) in **Fig 3** / smaller moment of weight (about **Y**) in **Fig 1** / (Because) S is larger in magnitude than D (to produce a greater moment (about **Y** because they are equal distances from **Y**)) ✓

3

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Q2.

- (a) MP1 is for evidence of determining the charge on the nucleus. ✓

$$\text{Charge} = 4.39 \times 10^7 \times 8.02 \times 10^{-26} \text{ kg} \\ (= 3.52 \times 10^{-18} \text{ C})$$

MP2 is for evidence of determining either the number of protons OR the number of nucleons.

✓

$$\text{Number of protons} = \text{charge} / 1.6 \times 10^{-19} (= 22)$$

OR

Number of nucleons

$$= 8.02 \times 10^{-26} / 1.67 \times 10^{-27} (= 48)$$

MP3 is for determining number of neutrons. ✓

$$\text{Number of neutrons} = 48 - 22 = 26$$

Note use of 1.7 gives 27 neutrons and loses MP3

3

- (b) Evidence of conversion of MeV to J ✓

$$\text{Energy} = 2.15 \times 10^8 \times 1.6 \times 10^{-19} (= 3.44 \times 10^{-11} \text{ J}) - \text{allow POT error in MP1}$$

Substitution into KE equation ✓

$$v^2 = 2E/m = 8.58 \times 10^{14}$$

Correct final answer ✓

$$v = 2.9(3) \times 10^7 \text{ m s}^{-1}$$

3

- (c) $\pi^+ \rightarrow e^+ + \nu_e$

OR

$$\text{charge: } 1 = 1 + 0 \checkmark$$

$$\text{B: } 0 = 0 + 0$$

AND

$$\text{L: } 0 = -1 + 1 \checkmark$$

$$\text{(S: } 0 = 0 + 0)$$

2

- (d) $(K^+ \rightarrow \mu^+ + \nu_\mu)$

Correct strangeness

$$+1 = 0 + 0 \checkmark$$

Weak interaction so strangeness can change (by 0, +1 or -1) ✓

2

- (e) Decay consistent with Q B L conservation ✓

Equation involving pions ✓

e.g.

$$K^+ \rightarrow \pi^+ + \pi^+ + \pi^-$$

$$K^+ \rightarrow \pi^+ + \pi^0$$

2

[12]