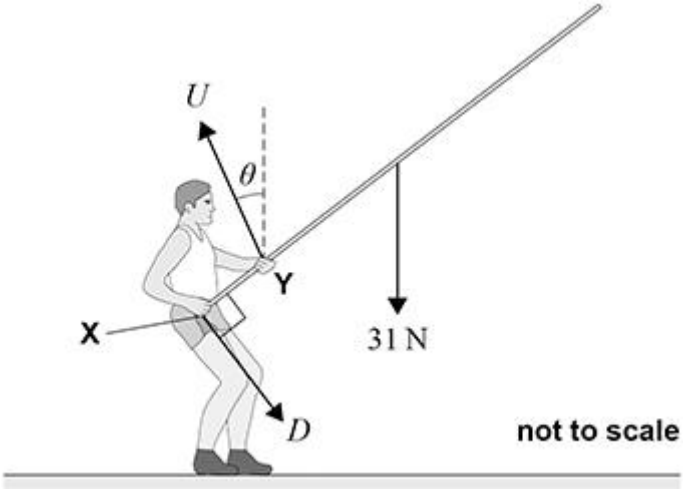
Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

Figure 1 shows an athlete holding a vaulting pole at an angle of 40° to the horizontal.

Figure 1



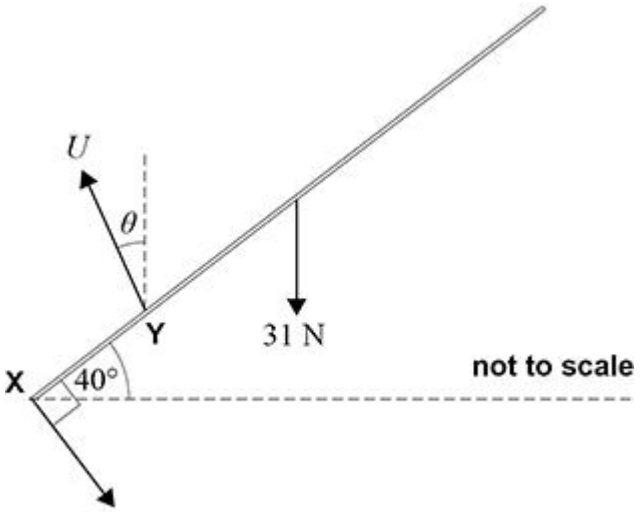
Forces D and *U* are exerted on the pole by the athlete's right and left hands respectively.
U is applied at point **Y** at an angle *θ* to the vertical.
The magnitude of D is 53 N and is applied at 90° to the pole at **X**.

The uniform pole is in equilibrium. It has a weight of 31 N.

Figure 2 shows the forces acting on the pole.

Figure 2

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(a) Determine, using a scale Figure, θ and the magnitude of U.

θ = _____ °

magnitude of U = _____ N

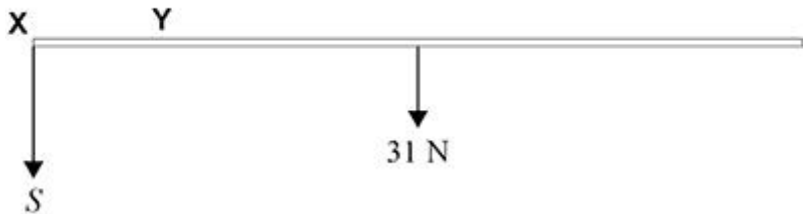
(4)

(b) The athlete now moves the pole to a horizontal position. The pole is held stationary in this position.
The athlete's right hand applies a force S vertically downwards at **X** as shown in **Figure 3**. The athlete's left hand applies a force V at **Y**.

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Figure 3

not to scale



Discuss the differences between the magnitudes and directions of force U in **Figure 1** and force V applied at **Y** in **Figure 3**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

Q2.

Cosmic rays are high-energy particles that come from space. Most of these particles are protons. There are other particles in cosmic rays, including atomic nuclei.

The table below gives the data for one particular nucleus **X**.

Mass / kg	8.02×10^{-26}
Specific charge / C kg^{-1}	4.39×10^{7}
Kinetic energy / MeV	215

(a) Determine the number of neutrons in nucleus **X**.

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number of neutrons = _____

(3)

(b) Calculate the speed of **X**.
Ignore relativistic effects.

speed = _____ m s^{-1}

(3)

A pion (π^+) and a kaon (K^+) are produced when cosmic rays interact with the upper atmosphere.

(c) The π^+ decays to produce a positron and an electron neutrino.

Show how the conservation laws apply to this decay.

_____

_____

_____

_____

_____

(2)

(d) The K^+ decays to produce an anti-muon and a muon neutrino.

Explain how strangeness applies in this decay.

_____

_____

_____

_____

(2)

(e) Write an equation for a K^+ decay that involves only hadrons.

_____

(2)

(Total 12 marks)

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