Question 2: Experimental Design — 12 points

(a)

For measuring the radius or diameter of rods with different radii using an appropriate tool	**1 point**
For measuring force using an appropriate tool	**1 point**
For a plausible/practical way to directly or indirectly determine F_{max} for a given rod	**1 point**
For attempting to reduce experimental uncertainty in an experiment that involves breaking the rods	**1 point**

Example response for part (a)

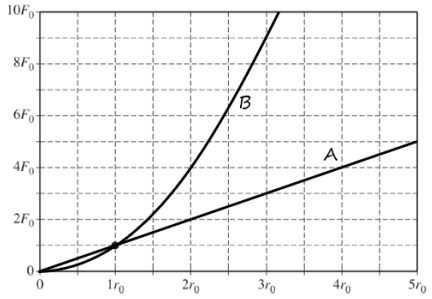
Measure the diameter D of each rod with a ruler.
Students should pull on the rod with the force probe until the rod breaks.
Record the force F_{max} just before breaking.
Repeat each trial several times to reduce error.
Then trade for a new set of rods with different radii.
Repeat this experiment for several different radii rods.

Total for part (a) 4 points

(b)

For a straight-line graph marked "A" with a slope of $\frac{F_0}{r_0}$	**1 point**
For a graph marked "B" that is concave up	**1 point**
For a graph marked "B" that shows a quadratic relationship at the correct points	**1 point**
For two graphs that both contain the point (r_0, F_0)	**1 point**

Example response for part (b)

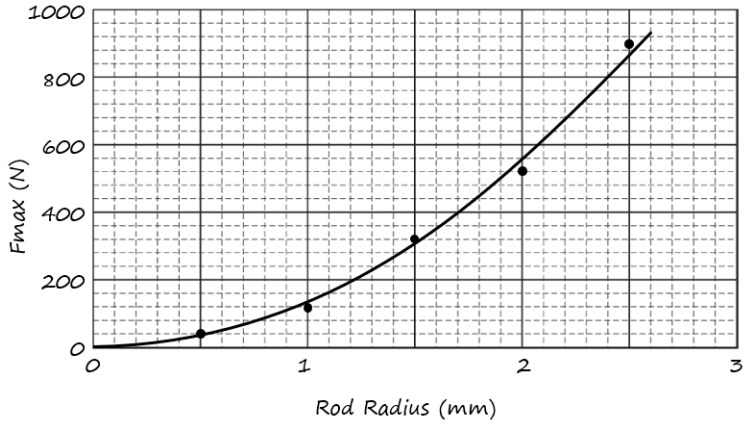


Total for part (b) 4 points

(c)

For linear scales with appropriate labels and units **AND** for a graph where the plotted points cover at least half of the grid's width and height	**1 point**
For plotting the points correctly	**1 point**
For drawing a reasonable best-fit curve	**1 point**

Example response for part (c)



Total for part (c) 3 points

(d)

For identifying Model B and for indicating that F_{max} increases as the square of the radius increases	**1 point**

Example response for part (d)

In this graph, F_{max} seems to be proportional to R^2, so that if we graph F_{max} on the vertical axis and R^2 on the horizontal axis, it should show a linear graph.

Total for question 2 12 points