Answers to exam-style questions

**Topic 1**

Where appropriate, 1 ✓ = 1 mark

1 B
2 A
3 D
4 B
5 A
6 D
7 C
8 A
9 C
10 A

11 Use a smaller heavier ball. ✓
   In order to minimise the effect of air resistance. ✓
   Let the ball drop from various heights. ✓
   In order to draw a graph of height versus time and get the acceleration through the gradient of the graph. ✓
   If a stopwatch is to be used measure the time for each height many times and get an average. ✓
   In order to get a more accurate value for the time. ✓

12 a It will take \(\frac{30}{4.0} = 7.5\) s to get across. ✓
   And he will move \(3.0 \times 7.5 = 22.5 = 22\) m to the right of P. ✓

b Correct diagram. ✓

\[
\sin \theta = \frac{3.0}{4.0} = 0.75 \checkmark
\]

\[
\theta = \sin^{-1} 0.75 = 48.6^\circ \checkmark
\]

![Diagram](sqrt(4.0^2 - 3.0^2) = 2.6458 m s^{-1}. ✓
   So she will take a time of \(\frac{30}{2.6458} = 11.3\) s, so will be longer than the man. ✓

13 a Smooth curve. ✓
   Through all the error bars. ✓
b The vertical intercept is about 0.1 s. ✓

c For $T$ to be proportional to $F$ requires a straight line graph through the origin. ✓
    And here neither of these conditions are satisfied. ✓

d The uncertainty in $T$ is about $\pm 0.035$ s. ✓
    
    \[
    \frac{\Delta T^2}{T^2} = 2 \frac{\Delta T}{T} \Rightarrow \Delta T^2 = 2T \Delta T \checkmark
    \]
    
    Hence $\Delta T^2 = \pm 2 \times 1.0 \times 0.035 = \pm 0.07 \ s^2 \checkmark$

e Correct plotting of points. ✓
    Correct error bars and lines of maximum and minimum slope. ✓
    Line of best-fit is straight and within uncertainties passes through origin. ✓
    Hence claim is correct. ✓

f Slope of line of best fit $0.164 \ s^2 \ N^{-1}$. ✓
    Max/min slopes $0.153 \ s^2 \ N^{-1}$ and $0.180 \ s^2 \ N^{-1}$ so uncertainty is $0.0135 = 0.01 \ s^2 \ N^{-1}$. ✓
    So $(0.164 \pm 0.001) \ s^2 \ N^{-1}$. ✓