TIMING GUNSHOT SOUNDS SOLUTION

QUESTION 1

To calculate the average time recording, we add up the four times and then divide by 4:

$$Average\ time\ recording\ = \frac{1.24\ +\ 1.17\ +\ 1.56\ +\ 1.21}{4}$$

$$Average\ time\ recording\ =\ \mathbf{1.295\ seconds}\ \text{(1 mark)}$$

QUESTION 2

The 1.24, 1.17 and 1.21 second recordings are all quite close. However, the 1.56 second recording is very different – it may be that Drake has made an error when recording the third time. We should discard the 1.56 second recording as an outlier and recalculate the average time based on the remaining three times: **(1 mark)**

$$Average\ time\ recording\ = \frac{1.24\ +\ 1.17\ +\ 1.21}{3}$$

$$Average\ time\ recording\ =\ \mathbf{1.207\ seconds}\ \text{(1 mark)}$$

QUESTION 3

To calculate the distance to the sniper, we need to multiply the speed of sound by the average time interval:

$$Distance\ =\ speed\ of\ sound \times average\ time\ interval$$

$$Distance\ =\ 340\ m/s \times 1.207\ s$$

$$Distance\ =\ \mathbf{410.4\ m}\ \text{(1 mark)}$$

QUESTION 4

We know the distance that the bullet travels to get from the sniper to Drake. If we can calculate how long it takes to travel that distance, we can calculate the bullet's average speed.

$$Bullet\ time\ =\ average\ measured\ time\ interval\ –\ 0.8\ seconds$$

$$Bullet\ time\ =\ 1.207\ seconds\ –\ 0.5\ seconds$$

$$Bullet\ time\ =\ \mathbf{0.707\ seconds}\ \text{(1 mark)}$$

Speed is distance divided by time:

$$Bullet\ average\ speed\ =\ distance\ /\ time$$

$$Bullet\ average\ speed\ =\ 410.4\ m\ /\ 0.707\ seconds$$

$$\boldsymbol{Bullet\ average\ speed\ =\ 580.5\ m/s}\ \text{(1 mark)}$$

To calculate the Mach number of the bullet (how many times faster than the speed of sound it is travelling), we need to divide the bullet speed by the speed of sound:

$$Bullet\ Mach\ number\ =\ bullet\ speed\ /\ speed\ of\ sound$$

$$Bullet\ Mach\ number\ =\ 580.5\ /\ 340$$

$$\boldsymbol{Bullet\ Mach\ number\ =\ 1.707}\ \text{(1 mark)}$$