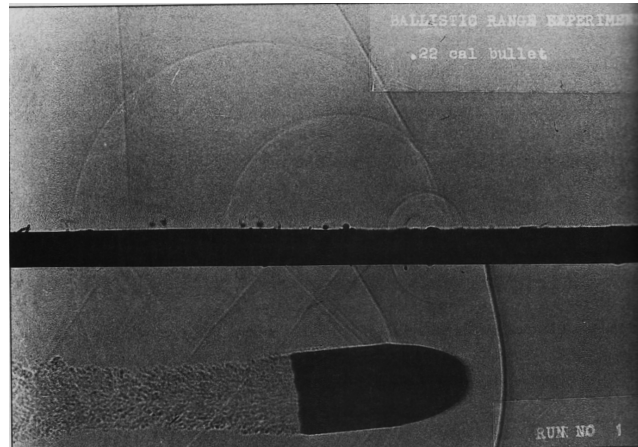


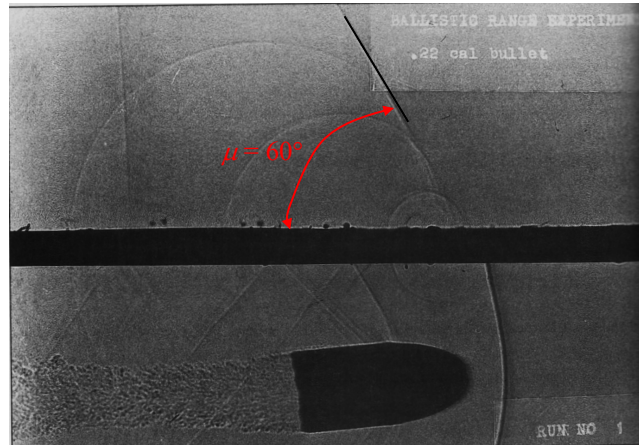
Determine the Mach number of the .22 caliber bullet shown below. Note that the plate in the figure has holes through which weak pressure disturbances can propagate.



If the temperature of the air at which the test is conducted is 70 °F, determine the speed of the bullet.

SOLUTION:

Determine the Mach angle from the photograph. Note that since the waves above the plate are very weak, they will be Mach waves.



The angle of the Mach waves is related to the Mach number via:

$$\boxed{\sin \mu = \frac{1}{\text{Ma}}} \quad \text{and } \mu = 60^\circ \Rightarrow \boxed{\text{Ma} = 1.2} \quad (1)$$

Now determine the speed of the bullet from the definition of the Mach number.

$$\text{Ma} = \frac{V}{c} \Rightarrow V = c\text{Ma} \quad (2)$$

$$\boxed{\therefore V = \text{Ma} \sqrt{\gamma RT}} \quad (3)$$

For air at 70 °F (530 °R) and  $\text{Ma} = 1.2$ ,  $\gamma = 1.4$ ,  $R = 53.3 \text{ (lb}_r\text{ft)/(lb}_m\text{.}^\circ\text{R)}$   $\Rightarrow \boxed{V = 1350 \text{ ft/s}}$