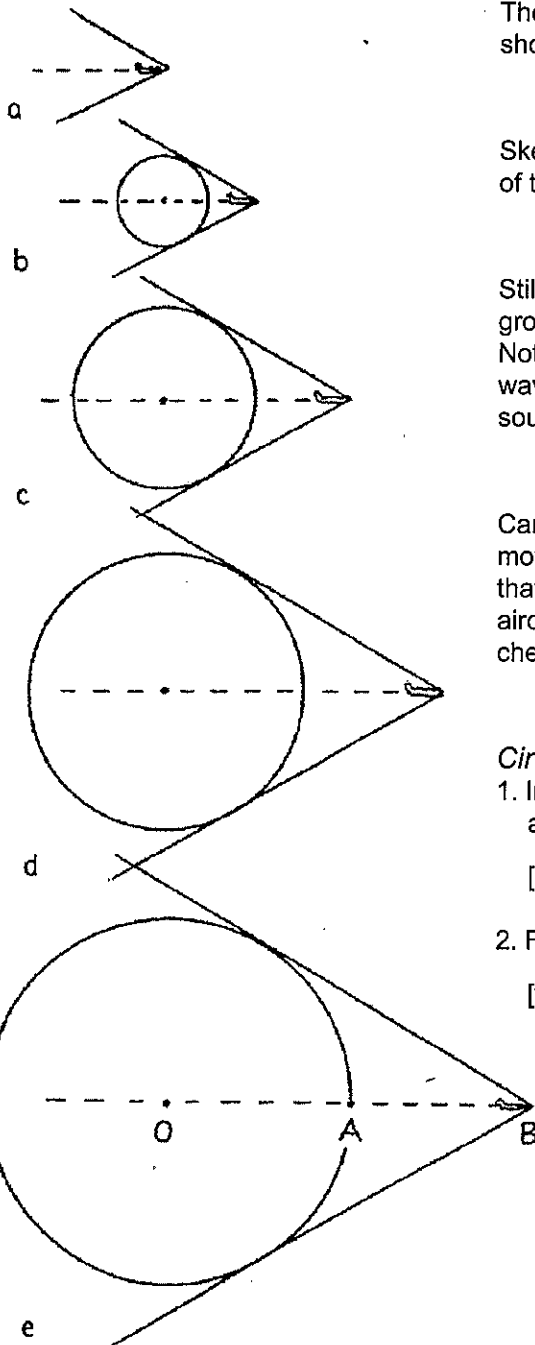


CONCEPTUAL *Physics* PRACTICE PAGE

Chapter 19 Vibrations and Waves Shock Waves

The cone-shaped shock wave produced by a supersonic aircraft is actually the result of overlapping spherical waves of sound, as shown in Figure 19.20 in your textbook. Sketches *a* through *e* below show the "animated" growth of only one of the many spherical sound waves (as an expanding circle in the two-dimensional drawing).



The circle originates when the aircraft is in the position shown in *a*.

Sketch *b* shows both the growth of the circle and position of the aircraft at a later time.

Still later times are shown in *c*, *d*, and *e*. Note that the circle grows and the aircraft moves farther to the right. Note also that the aircraft is moving farther than the sound wave. This is because the aircraft is moving faster than sound.

Careful examination will reveal how fast the aircraft is moving compared to the speed of sound. Sketch *e* shows that in the same time the sound travels from *O* to *A*, the aircraft has traveled from *O* to *B*—twice as far. You can check this with a ruler.

Circle the correct answers.

1. Inspect sketches *b* and *d*. Has the aircraft traveled twice as far as sound in the same time in these positions also?

[Yes] [No]

2. For greater speeds, the angle of the shock wave would be

[wider] [the same] [narrower].

DURING THE TIME THAT SOUND TRAVELS FROM *O* TO *A*, THE PLANE TRAVELS TWICE AS FAR --- FROM *O* TO *B*.

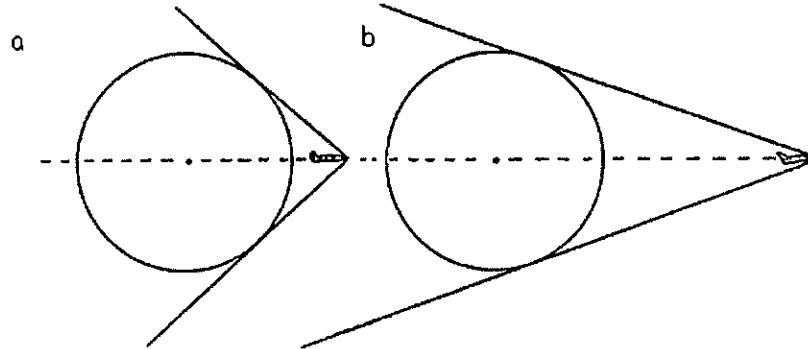
SO IT'S FLYING AT TWICE THE SPEED OF SOUND!



Hewitt
Jawitt!

Chapter 19 Vibrations and Waves
Shock Waves—continued

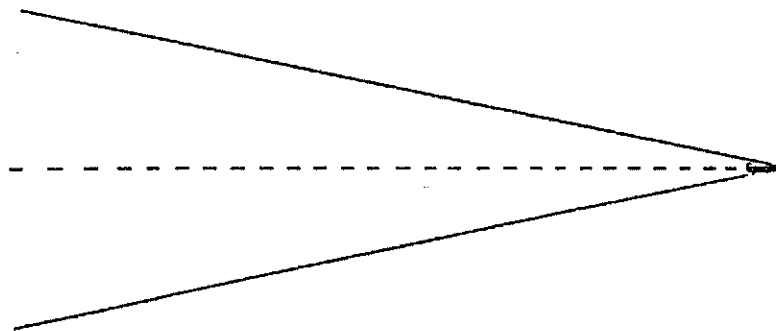
3. Use a ruler to estimate the speeds of the aircraft that produce the shock waves in the two sketches below.



Aircraft *a* is traveling about _____ times the speed of sound.

Aircraft *b* is traveling about _____ times the speed of sound.

4. Draw your own circle (anywhere) and estimate the speed of the aircraft to produce the shock wave shown below:



The speed is about _____ times the speed of sound.

5. In the space below, draw the shock wave made by a supersonic missile that travels at four times the speed of sound.

Hewitt
 Drew it!