A train is moving on a straight track with speed 20 ms^{-1}. It is blowing its whistle at the frequency of 1000 Hz. The percentage change in the frequency heard by a person standing near the track as the train passes him is (speed of sound = 320 ms^{-1}) close to :

(1) 12%

(2) 18%

(3) 24%

(4) 6%

We have, $f_{heard} = f\left(\frac{V + V_{listener}}{V - V_{source}}\right)$ with appropriate signs for $V_{listener}$ and V_{source}.

$f' = 1000 \times \left(\frac{320}{320 - 20}\right) = \frac{32,000}{30}$ when the train is approaching

$f'' = 1000 \times \left(\frac{320}{320 + 20}\right) = \frac{32,000}{34}$ when the train is moving away

% change in frequency = $\frac{f' - f''}{f'} \times 100$

$$= \frac{\frac{32,000}{30} - \frac{32,000}{34}}{\frac{32,000}{30}} \times 100 = \frac{\frac{1}{30} - \frac{1}{34}}{\frac{1}{30}} \times 100$$

$$= \frac{4}{34} \times 100 \approx 12\%$$

Hence, Option (1).