15 A

6. $f(x) = k \sin\left(\frac{\pi(x-7)}{10}\right) \qquad 7 \le x \le 17$

a) for this to be a pdf, $\int f(x)\,dx = 1$

now $\int f(x)\,dx = \int_7^{17} k \sin\left(\frac{\pi(x-7)}{10}\right) dx$

$$\therefore 1 = \left[\frac{10}{\pi} x - k\cos\left(\frac{\pi(x-7)}{10}\right)\right]_7^{17}$$

$$= \frac{-10k}{\pi}\left[\cos\left(\frac{\pi(17-7)}{10}\right) - \cos\left(\frac{\pi(7-7)}{10}\right)\right]$$

$$= \frac{-10k}{\pi}\left[\cos(\pi) - \cos(0)\right]$$

$$= \frac{-10k}{\pi}\left[-1-1\right]$$

$$= \frac{-10k}{\pi} \times -2$$

$$\therefore 1 = \frac{20k}{\pi}$$

$$\therefore 1 \times \frac{\pi}{20} = k$$

$\therefore k = \frac{\pi}{20}$ as required

b) i) $\int_{16}^{17} k \sin\left(\frac{\pi(x-7)}{10}\right) dx$

$$= \int_{16}^{17} \frac{\pi}{20} \sin\left(\frac{\pi(x-7)}{10}\right) dx$$

$= 0.024 \quad = \boxed{2.4\%}$

ii) $\int_{12}^{13} \frac{\pi}{20} \sin\left(\frac{\pi(x-7)}{10}\right) dx \quad = 0.155$

$\boxed{= 15.5\%}$