AC generator produces emf:
\[ E = 100 \sin(376.99 t) \]  \hspace{0.5cm} (1)

General formula for AC generator's emf is Eq. (20.7)
\[ E = NABw \sin(\omega t) \]  \hspace{0.5cm} (2)

if you draw a graphic then

\[ E \]

\[ NABw \]

\[ -NABw \]

\[ \Rightarrow E_{\text{max}} = NABw \]

comparing (1) and (2):

(a) \[ E_{\text{max}} = NABw = 100 \]

\[ \Rightarrow \boxed{E_{\text{max}} = 100 \text{ V}} \] (i.e. maximal voltage)

(b) \[ \omega t = 376.99 t \]

\[ \omega = 376.99 \]

but \ \[ \omega = 2\pi f \] where \( f \) - frequency

\[ \Rightarrow f = \frac{376.99}{2\pi} \approx 60 \text{ Hz} \]

\[ \Rightarrow \boxed{f = 60 \text{ Hz}} \]
Strip OA for time $\Delta t$ moves to position OB and covers area $\Delta S$. (covers angle $\Delta \varphi$)

We need to find e.g. for $\Delta S = \Delta S(\Delta t)$
(i.e. $\Delta S \sim \Delta t$)

It's important to notice that

\[
\frac{\Delta S}{S} = \frac{\Delta \varphi}{2\pi}
\]

($S$ - circle's area) (2$\pi$ - circle's angle)

(you can see this, for ex.:)

\[
\frac{\Delta S}{S} = \frac{\frac{\pi}{2}}{2\pi} = \frac{1}{4}
\]

But by definition:

\[
\omega \equiv \frac{\Delta \varphi}{\Delta t} \Rightarrow \Delta \varphi = \omega \Delta t
\]

Therefore

\[
\frac{\Delta S}{S} = \frac{\omega \Delta t}{2\pi}
\]

Note that $S$ for circle is:

\[
S = \pi r^2
\]

\[
\Rightarrow \frac{\Delta S}{\pi r^2} = \frac{\omega \Delta t}{2\pi}
\]
\[ \Delta S = \frac{\pi r^2 w \Delta t}{2 \pi} = \frac{1}{2} r^2 w \Delta t \]

\[ \Delta S = \frac{1}{2} r^2 w \Delta t \]  \( (*) \)

**EMF can be calculated by:**

\[ E = -\frac{\Delta \Phi}{\Delta t} \]  \( \text{ (see Eq. 20.2 for example)} \)

but \( \Delta \Phi = B \Delta S \) (by definition)

\[ \Rightarrow E = -\frac{B \Delta S}{\Delta t} \]

plug in \( (*) \):

\[ E = -\frac{B}{\Delta t} \left( \frac{1}{2} r^2 w \Delta t \right) = -\frac{1}{2} r^2 w B \]

\[ \Rightarrow E = -\frac{1}{2} r^2 w B \]  \( (1) \)

From other side Ohm's law says:

\[ I = \frac{E}{R}, \text{ i.e. } E = IR \]  \( (2) \)

therefore \( (1) \) and \( (2) \) give us:

\[ IR = -\frac{1}{2} r^2 w B \]

\[ \Rightarrow B = -\frac{2IR}{r^2 w} \]  \( (3) \)

Note that we have \( w \) in rpm's and we have to convert it to rad/s to plug in \( (3) \):

\[ w = 360 \text{ rpm} = \frac{360 \cdot 2\pi}{60} = 37.7 \text{ rad/s} \]

(since 1 rotation = \( 2\pi \) radians)

(1 minute = 60 seconds)

\[ w = 37.7 \text{ rad/s} \]
So plug in all #’s to (3) we can get

\[ B = 21 \times 10^{-3} \, T \]

20.67

Simple AC generator’s coil is

\[ \text{rotation} \]
\[ \text{axis of rotation} \]

To calculate area of coil:

\[ A = (2r) \cdot l \]

plug in #’s: \[ A = 2 \times 10^{-2} \, m^2 \]

We need to convert \( \omega \) which is in rpm to rad/s:

\[ \omega = 6000 \, \text{rpm} = \frac{6000 \cdot 2\pi}{60} = 628.3 \, \text{rad/s} \]

Use Eq. (20.7) to calculate EMF:

\[ \epsilon = N A B \omega \sin \omega t \]  
\[ (N - \# \text{ of turns}) \]

\[ \Rightarrow \]

\[ \epsilon = 1.3 \times 10^3 \sin (628.3 t) \]
Current after switch is closed:

\[ I = \frac{V}{R} \]  
(Note \( R_b = 0 \))

Use Ohm's law

\[ I = 2 \text{ A} \]