[1] Capacitive reactance:

$$X_C = \frac{1}{2\pi FC}$$

X_C => capacitive reactance (Ω)

F => frequency in cps

C => capacity in farad (F)

2π => 6.28

[2] inductive reactance:

$$X_L = 2\pi FL$$

X_L => inductive reactance (Ω)

2π => 6.28

F => frequency in cps

L => inductor in Henry (H)

[3] Frequency (f) : in Hz

$$f = \frac{1}{T}$$

T ⟸ period

complete full cycle in (seconds)

$$F = \frac{\text{Number of poles}}{2} \times \frac{\text{rpm}}{60}$$

$$\text{rps} = \frac{\text{rpm}}{60}$$

Example:
If in a 2-pole generator, the conductor is turning at 3,600 rpm, the revolutions per second are:

??

$$\text{rps} = \frac{3\,600}{60} = 60 \text{ revolutions per second}$$

Poles : 2

rpm : 3600 rpm

rps = ??

$$\text{rps} = \frac{\text{rpm}}{60}$$

$$= \frac{3600}{60}$$

$$\text{rps} = 60$$

What is the frequency of the 2-pole generator?

??

$$F = \frac{\text{Number of Poles}}{2} \times \frac{\text{rpm}}{60}$$

poles : 2

rpm : 60

F = ??

$F = \frac{2}{2} \times 60$

$= 1 \times 60$

$= 60\ Hz$

Example:

- If you have an induction motor of 8 poles and the conductor is turning at 2 400 rpm, what is the frequency of the generated electricity?

Use this formula: $F = \frac{\text{Number of Poles}}{2} \times \frac{\text{rpm}}{60}$

Answer:

poles : 8

rpm : 2400 rpm

F = ??

1) $rps = \frac{rpm}{60} = \frac{2400}{60}$

$= 40$

2) $F = \frac{\text{number of pole}}{2} \times rps$

$= \frac{8}{2} \times 40$

$4 \times 40 = 160\ Hz$

4) Period (T):

$$t = \frac{1}{f}$$

Example:
A waveform has a frequency of 400 Hz. What is the periodic time of the waveform?

$f = 400\ Hz$

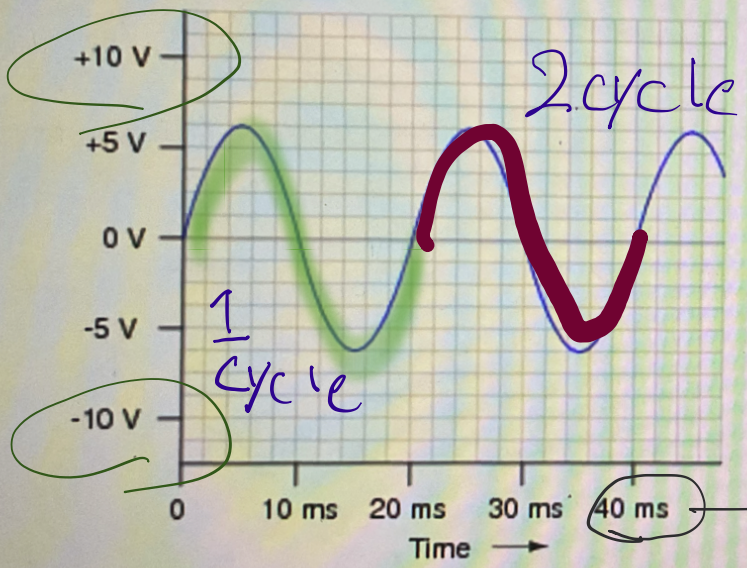
$t = ??$

$$t = \frac{1}{f}$$

$$= \frac{1}{400}$$

$$= 2.5 \times 10^{-3}\ s$$

Find the values of the period, amplitude and frequency of an AC voltage below.



Period is: $t = \frac{1}{f}$

Frequency is: $f = \frac{1}{t}$

time = 40 ms or 40×10^{-3} S

$t = ??$

$f = ??$

Amplitude ??

$$f = \frac{1}{T}$$

$$= \frac{2}{40 \times 10^{-3}}$$

$$= 50 \text{ Hz}$$

ف f يجب أن يحتوي على 2cycle

2cycle green and purple

$$T = \frac{1}{f}$$

$$= \frac{2}{50} \Rightarrow \frac{2}{\text{cycle}}$$

$$= 0.04 \text{ S}$$

Amplitude : peak value

highest point :
+10

lowest point :
−10

$$= \frac{\text{highest} - \text{lowest}}{2}$$

$$= \frac{10 - (-10)}{2}$$

$$= \frac{20}{2}$$

$$= 10\,V$$

[5] Average value

$$V_{Av} = \frac{V_1 + V_2 + V_3 \cdots}{\text{total}}$$

$$V_{Av} = 0.637\ V_p$$

[6] Effective Value or RMS

$$V_{rms} = 0.707\ V_p$$

[7] peak value

$$V_p = 1.414\ V_{rms}$$

[8] peak to peak

$$V_{pp} = 2\ V_p$$

always rms

[a] What is the peak value of voltage for a 220 Vac?

[b] The 110-volt value given for alternating current supplied to homes is only 0.707 of the maximum voltage of this supply. What is the maximum voltage? V_{max} → V_p

[c] A sinusoidal current has a peak-to-peak value of 40mA. What is its r.m.s. value?

$I = 40mA$ → V_{rms}

[a] $V_p = ??$

$V_{rms} = 220\ V$

$V_{rms} = 0.707\ V_p$

$\frac{220}{0.707} = \frac{0.707\ V_p}{0.707}$

b

$V_{max} = ??$

$V_{rms} = 0.707$

$V_p = 311.2\,V$

$V_{rms} = 0.707\,V_p$

$\frac{110}{0.707} = \frac{0.707\,V_p}{0.707}$

$V_p = 155.6\,V$

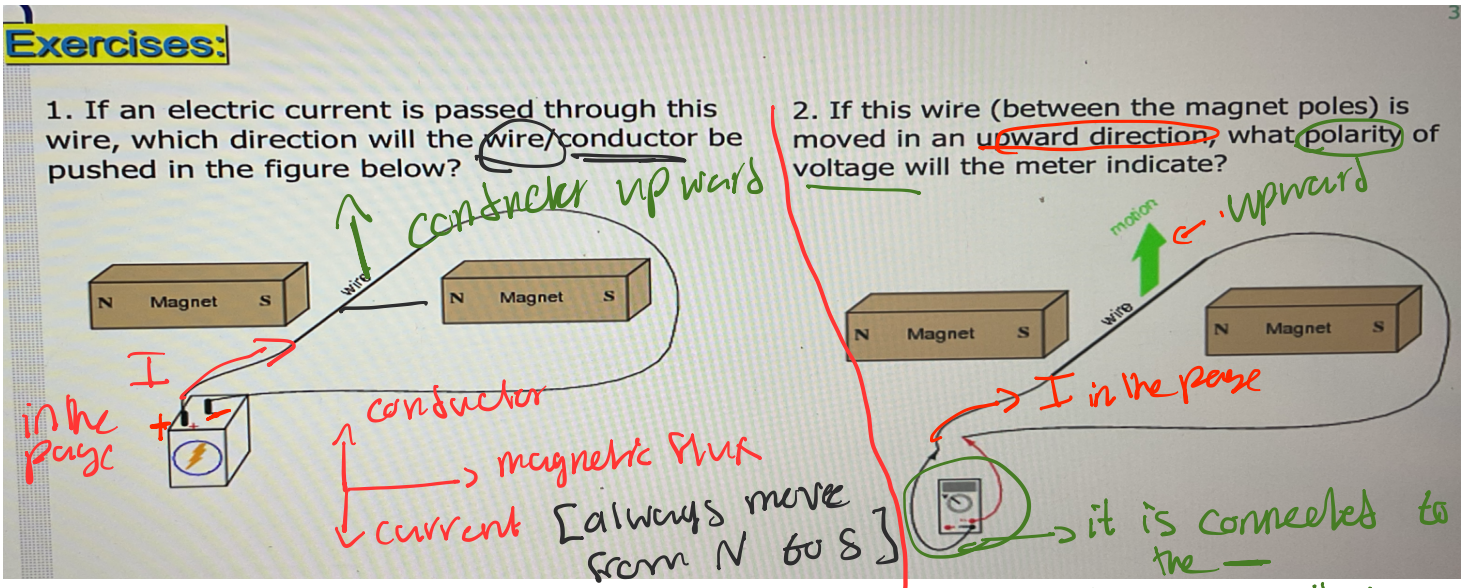
c $I_{pp} = 40\,mA$ or $40 \times 10^{-3}\,A$

$I_{rms} = ??$

$I_{rms} = 0.3535\,I_{pp}$

$= 0.3535 \times 40 \times 10^{-3}$

$= 0.014\,A$



* we gonna use left hand rule.

→ The direction of I is in the page away from you

polarity means it is + or —.

So the polarity is negative.

→ The wire / conductor is upward.

نستخدم left hand rule عشان نعرف

What is the direction ⇓ upward or downward

What is the polarity ⇓ negative or positive

Exercises:

3. A 100 Ω resistor is connected to a 220 V (rms), 50 Hz (F) AC supply.
   a) What is the rms value of current in the circuit?
   b) What is the net power consumed over a full cycle?

4. The electric supply in a house are marked 220V, 50Hz. What is its average voltage?

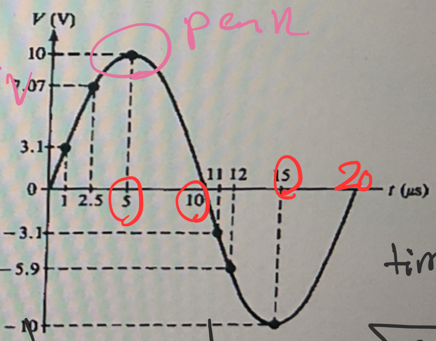
5. From the figure below, find the voltage values:

V_{peak}: 10 V

V_{rms}: $0.707 \times V_P \Rightarrow 0.707 \times 10 = 7.07$ V

V_{pk-pk}: $2 V_P \Rightarrow 2 \times 10 = 20$ V

V_{ave}: $0.637 \times V_P \Rightarrow 0.637 \times 10 = 6.37$



if it is asking about f: $f = \frac{1}{T} = \frac{1}{20 \mu s} = \frac{1}{20 \times 10^{-6}} = 50,000$ Hz

3

a. $V_{rms} = IR$

$\frac{220}{100} = \frac{I \times 100}{100}$

$2.2 A = I$

b. $P = VI$

$= 220 \times 2.2$

$= 484$ W

4

$V_{ave} = 0.637 V_P$

[1] $V_P = \frac{220}{0.707}$

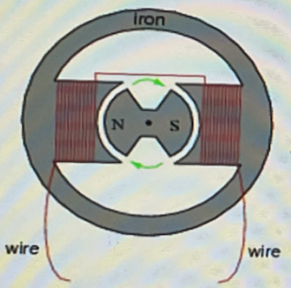
$V_P = 311.2$

[2] $V_{ave} = 0.637 \times 311.2$

$= 198.2$ V

Exercises:

6. If the alternator shown below is spun at 4500 rpm, what will be the frequency of its output voltage?



7. How fast must a 12-pole alternator spin in order to produce 60 Hz AC power?

$$rps = \frac{rpm}{60}$$

6. $F = \frac{poles}{2} \times \frac{rpm}{60}$ → rps

$$= \frac{2}{2} \times \frac{4500}{60}$$

$$= 75\ Hz$$

7. $F = \frac{N}{2} \times rpm$

$$\frac{2}{12} \times \left[60 = \frac{2}{\cancel{12}} \cdot \frac{12}{2} \times \frac{rpm}{60}\right]$$

$60 \times 10 = \frac{rpm \times 60}{60}$

$600 = rpm$

إذا Shift solve تعدل انتي
ما تغرن نحل mathematical

Nouf ALbedwani