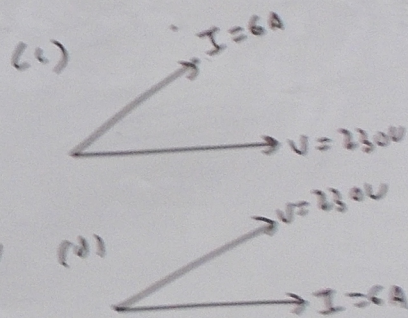
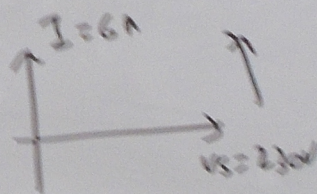
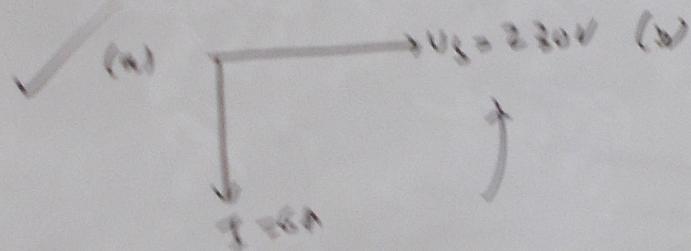


TUTORIAL

- ① A ROTARY GENERATOR IS TO BE RUN AT 1500 RPM TO GENERATE A 50 Hz FREQUENCY OUTPUT. HOW MANY POLES SHOULD THERE BE?
 (a) 2 (b) 4 (c) 6 (d) 8

- ② WHICH ONE OF THE PHASOR DIAGRAMS BELOW REPRESENTS THE RUNNING VOLTAGE AND CURRENT OF A SINGLE PHASE AC MOTOR?

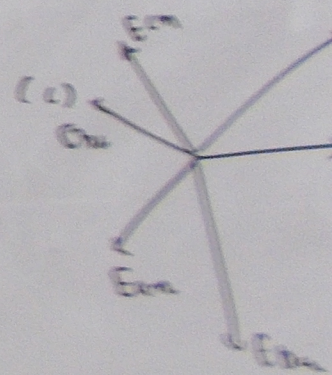
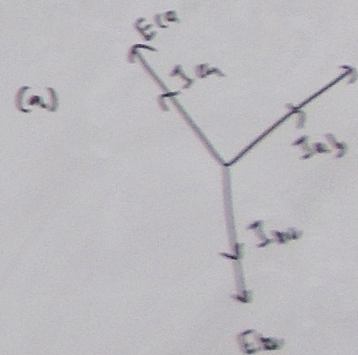


- ③ WHAT IS THE PEAK VALUE OF A 230V RMS AC VOLTAGE?
 (a) 100V (b) 400V (c) 550V (d) 630V

- ④ WHAT IS THE PERIOD OF A 50 Hz SUPPLY
 (a) 5ms (b) 10ms (c) 20ms (d) 25ms

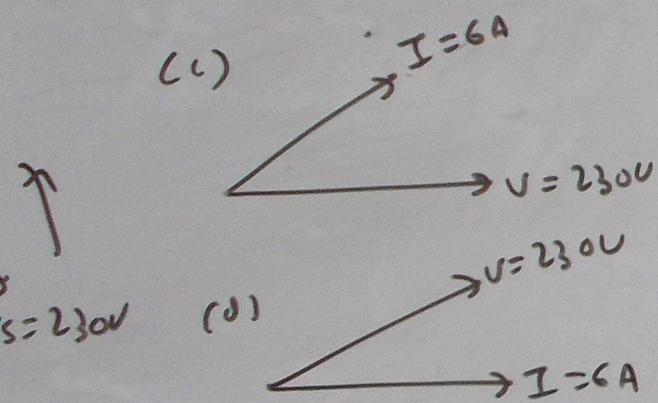
- ⑤ ONE REASON WHY POWER IS DESIRABLE?

- ⑥ WHICH OF THE PHASOR DIAGRAMS BELOW REPRESENTS THE PHASE LINE VOLTAGES?



AT 1500 RPM TO GENERATE.
POLES SHOULD THERE BE?

BELOW REPRESENTS THE
SINGLE PHASE AC MOTOR?



280V RMS AC VOLTAGE?

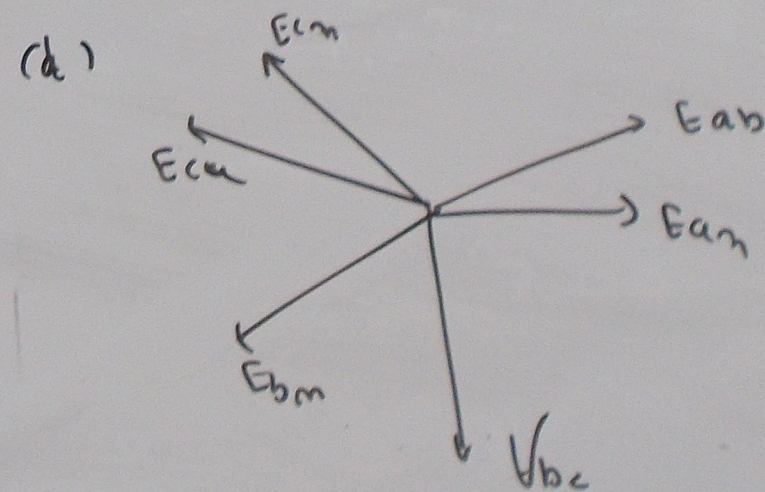
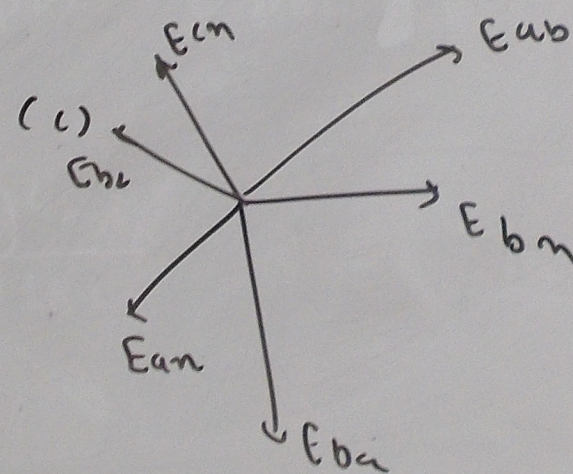
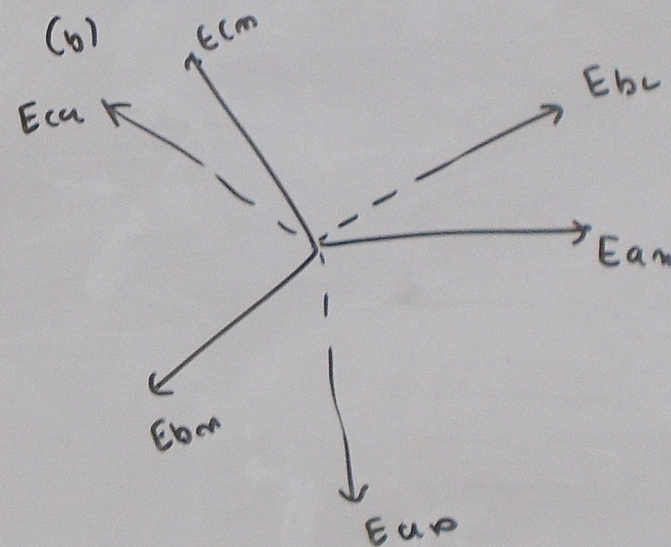
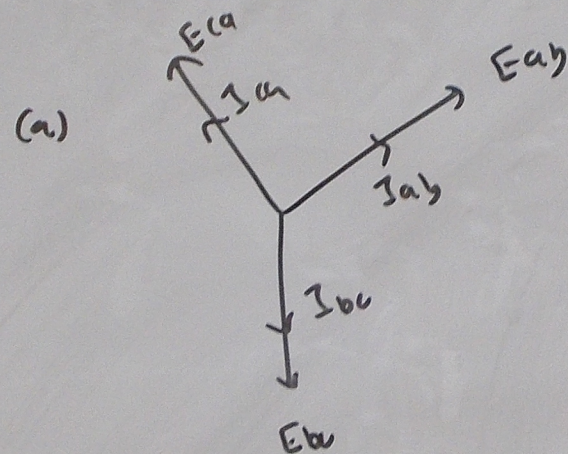
630V

Hz supply

25ms

(5) ONE REASON WHY POWER FACTOR CORRECTION (OR) IMPROVEMENT IS DESIRABLE?

(6) WHICH OF THE PHASOR DIAGRAMS BELOW REPRESENTS A 3PHASE AC SUPPLY WITH PHASE SEQUENCE ABC? E_{an}, E_{bm}, E_{cm} REPRESENT PHASE VOLTAGES AND E_{ab}, E_{bc}, E_{ca} REPRESENT LINE VOLTAGES.



(7) IF A
IN THE

(A) Ean

(B) Ebn

(C) Ecn

(D) Eab

(8) mu

(A) Ean

(B) Ebn

(C) Ecn

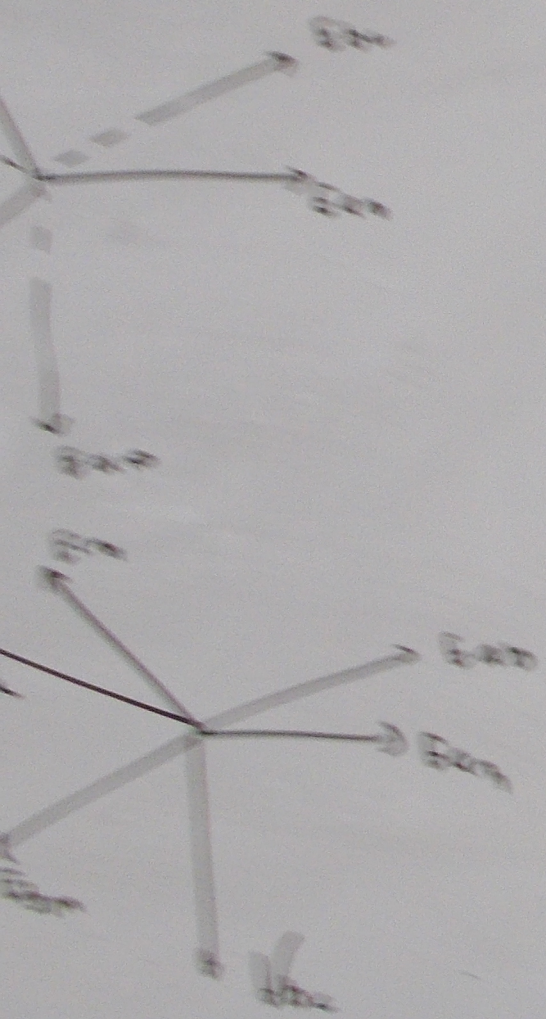
(D) Eab

(9) T

(10)

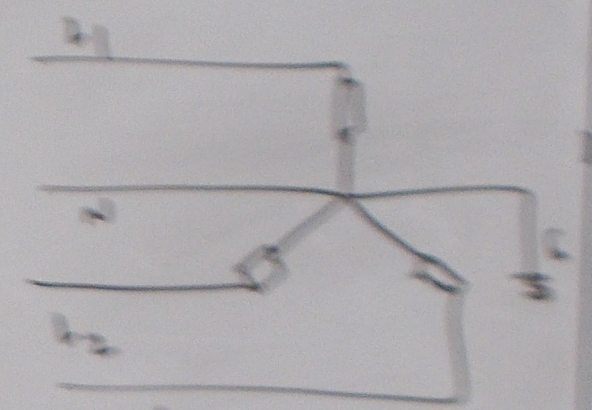
SECTION 60 IMPLEMENTATION IS

AND REPRESENTS A 3 PHASE
WAVE. Each line, line
to line, line to line dependent



8. IF A 3 PHASE ^{WAVE} IS FOUND TO BE ROTATING
IN THE WRONG DIRECTION. HOW IT IS CORRECTED?

- (A) EARTH THE MOTOR
- (B) CONNECT THE SUPPLY NEUTRAL TO MOTOR
- (C) CONNECT THE POWER FACTOR CAPACITORS
- (D) TRANSPOSE ANY TWO OF MOTOR SUPPLY CABLES



9. MULTIPLE EARTH FAULT NEUTRAL MEANS
(A) THE EARTH CONDUCTOR MUST CONSIST OF MULTIPLE WIRING
(B) THE SUBSTATION HAS MULTIPLE NEUTRALS EARTHED
(C) THE NEUTRAL ON EVERY POWER/LAMP POST IS EARTHED
(D) THE NEUTRAL AT EVERY HOME HAS IS EARTHED

10. THE LINE VOLTAGE OF A 3 ϕ SUPPLY IS 415V AC. WHAT IS
THE VOLTAGE MAINTAINED BETWEEN PHASE AND NEUTRAL?
(A) 380V (B) 276V (C) 240V (D) 115V

11. ELECTRICAL DEGREE IS EQUIVALENT TO HOW MANY PERIODS
(A) $\frac{1}{2}$ (B) 1 (C) 2 (D) 3

11. LAST ...
a. ...

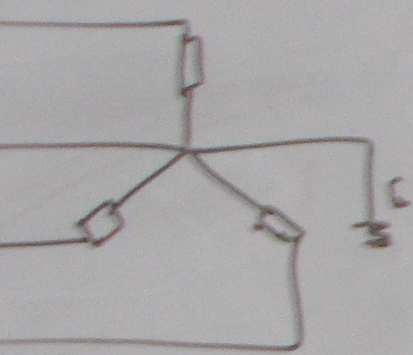
12. ...

A. ...
B. ...
C. ...

13. N =

$$S_{max} = \frac{12}{...}$$

$$P = \frac{12}{...}$$

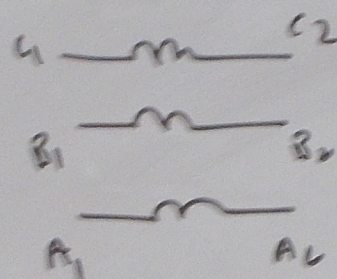


AC. WHAT IS NEUTRALS?
MANY PERIODS

11) LIST ONE SOURCE OF HARMONICS IN A 50 Hz POWER SYSTEM

12) CONNECT THE FOLLOWING 3 ϕ TRANSFORMER

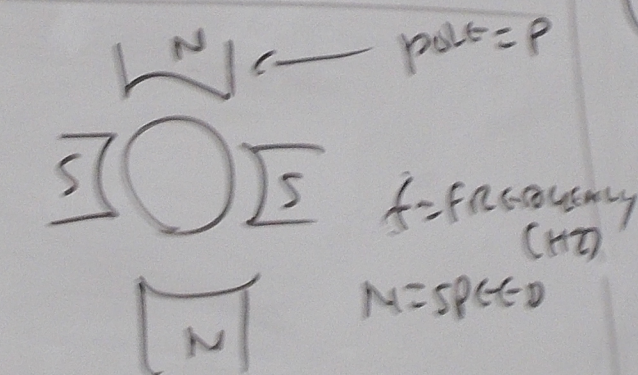
A _____
R _____
C _____



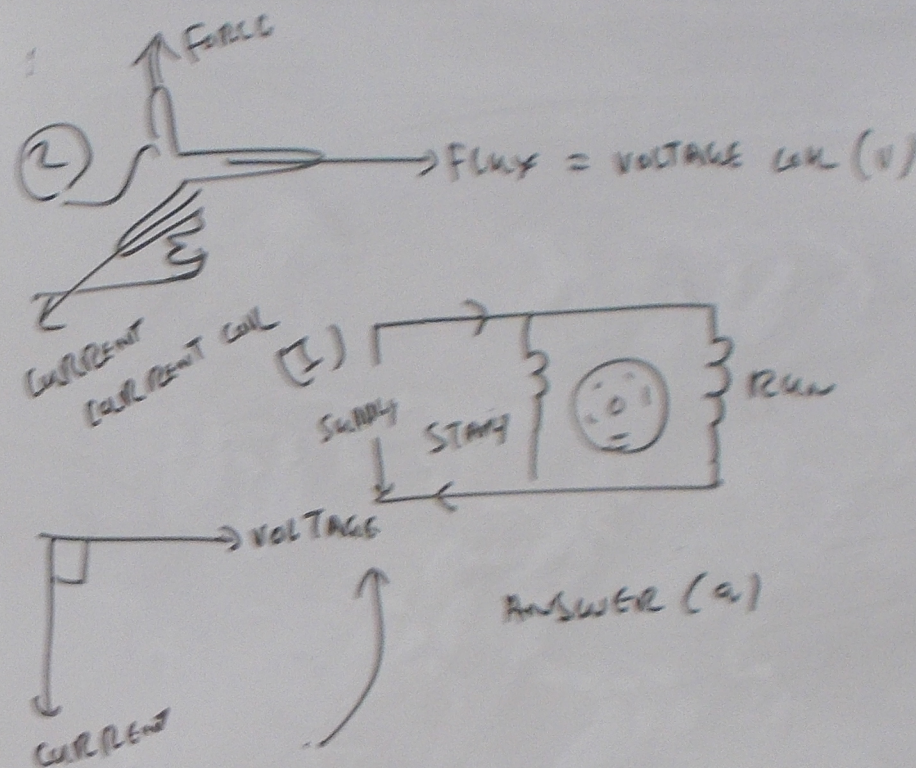
$$N = \frac{120f}{P}$$

$$1500 = \frac{120 \times 50}{P}$$

$$P = \frac{120 \times 50}{1500} = 4$$



ANSWER (b)



3) PEAK VALUE = $\sqrt{2} \times \text{RMS VALUE}$

$$= 1.4142 \times 280$$

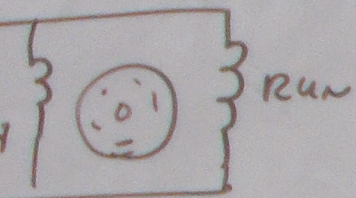
$$= 400 \text{ V} \quad \text{ANSWER (B)}$$

4) $T = \frac{1}{f} = \frac{1}{50} \text{ SEC} = \frac{1000}{50} \text{ ms}$

$$= 20 \text{ ms}$$

ANSWER (c)

$V_L = \text{VOLTAGE COIL (V)}$



ANSWER (a)

$\times \text{ RMS VALUE}$

2×280

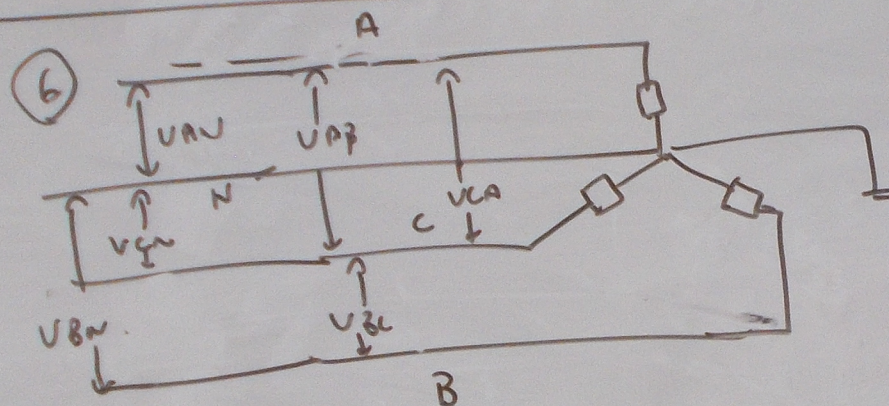
0 V ANSWER (b)

$$S_{EL} = \frac{1000}{50} \text{ ms}$$

$$= 20 \text{ ms}$$

(c)

⑤ TO REDUCE THE REACTIVE POWER WHICH CAUSE THE APPARENT POWER IMPACTING ON THE AMOUNT OF CURRENT DRAWN FROM SUPPLY.

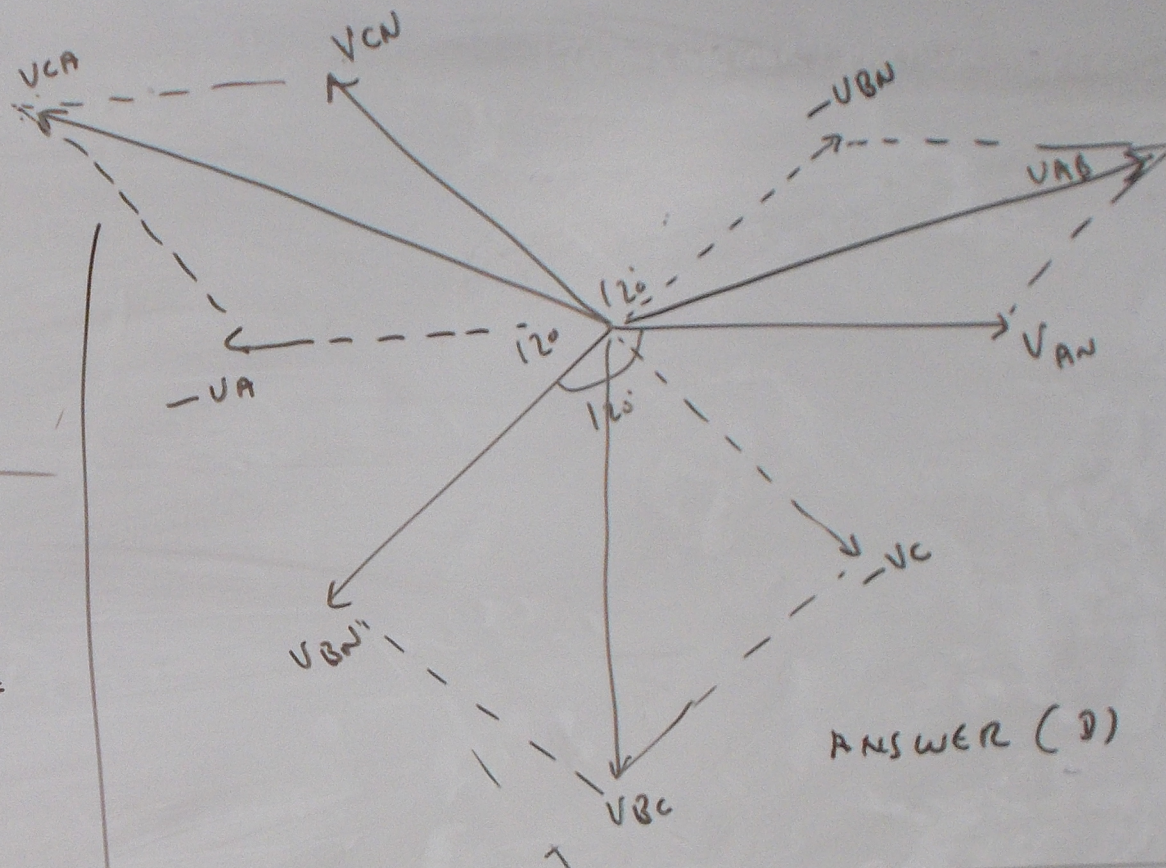


$V_{AB}, V_{BC}, V_{CA} = \text{LINE VOLTAGE}$
 $V_{AN}, V_{BN}, V_{CN} = \text{PHASE VOLTAGE}$

$$\vec{V}_{AB} = \vec{V}_A + (-\vec{V}_B)$$

$$\vec{V}_{BC} = \vec{V}_B + (-\vec{V}_C)$$

$$\vec{V}_{CA} = \vec{V}_C + (-\vec{V}_A)$$

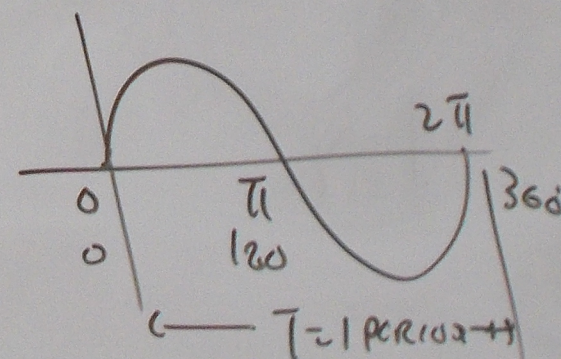


ANSWER (d)

⑨ $V_{\text{LINE}} = \sqrt{3} V_{\text{PHASE}}$

$$V_{\text{PHASE}} = \frac{V_{\text{LINE}}}{\sqrt{3}} = \frac{415}{1.732} = 240 \text{ V}$$

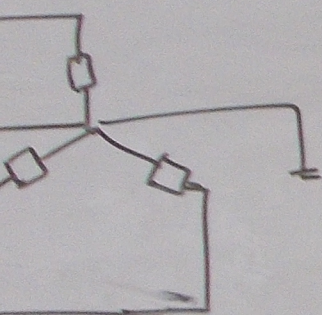
⑩



$\pi \rightarrow \frac{1}{2} \text{ PERIOD}$

ANSWER (A)

ACTIVE POWER
RENT POWER
OUNT OF
SUPPLY.

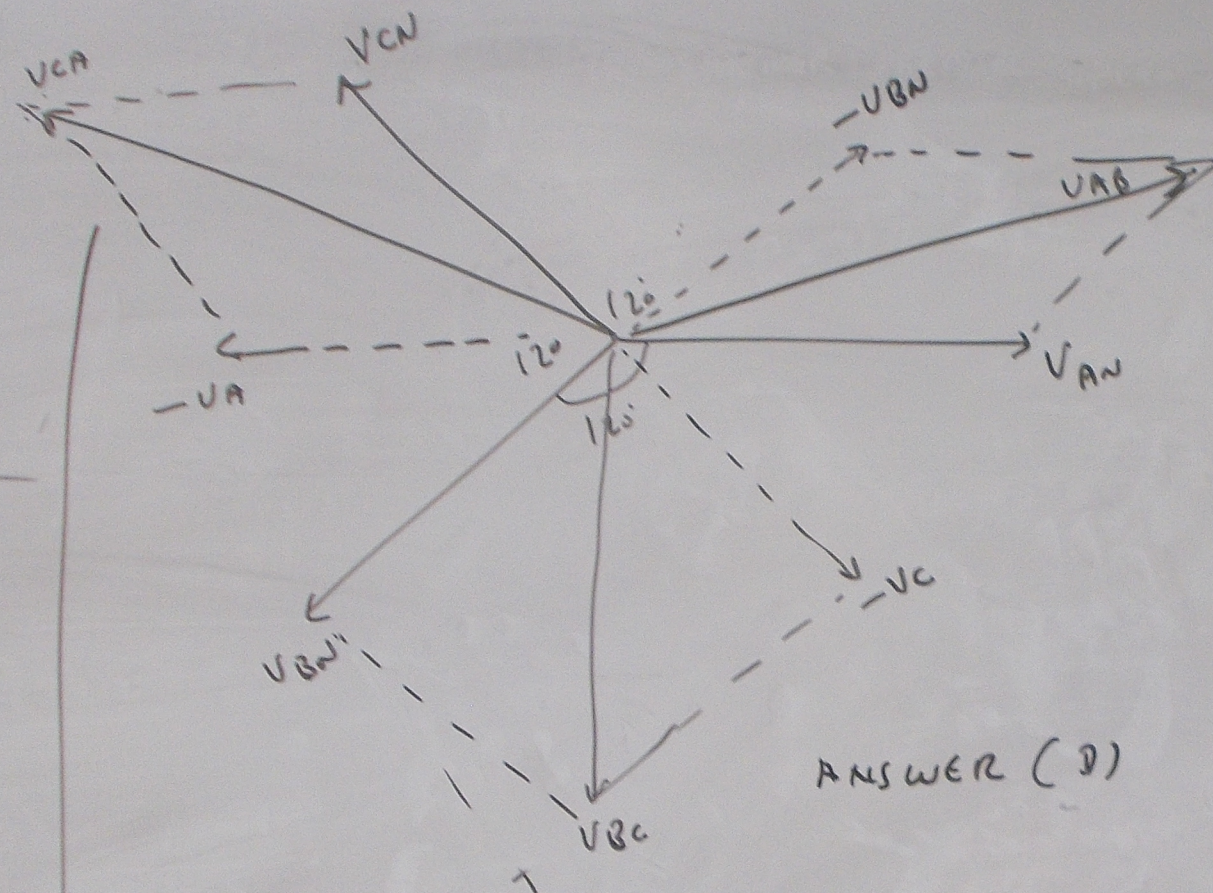


UNTAGE
E VOLTAGE

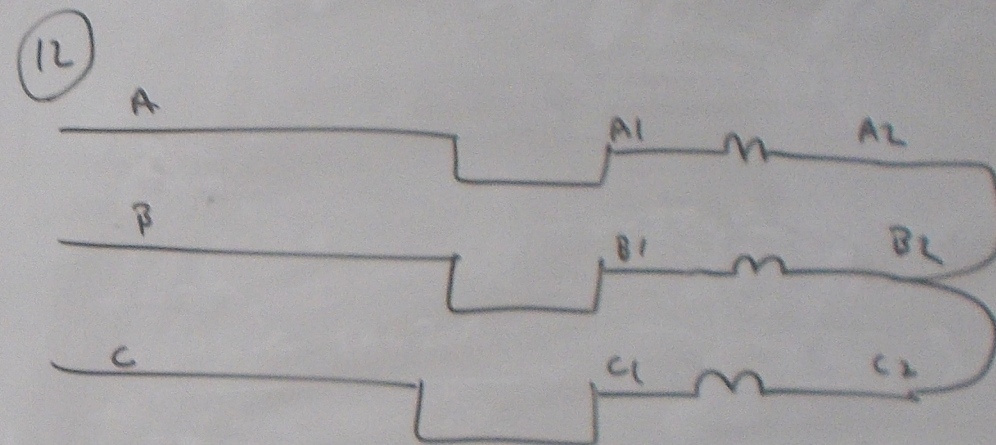
$\rightarrow -V_B$

$\rightarrow V_C$

$\rightarrow V_A$

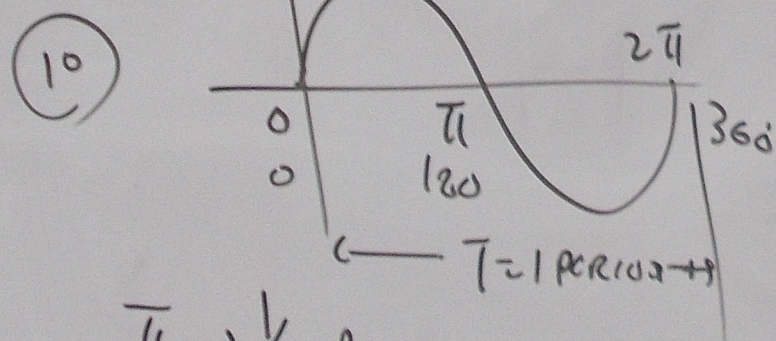


(11) HARMONIC = MULTIPLE TIME FUNDAMENTAL FREQUENCY CAUSED BY NON LINEAR LOADS



(9) $V_{LINE} = \sqrt{3} V_{PHASE}$

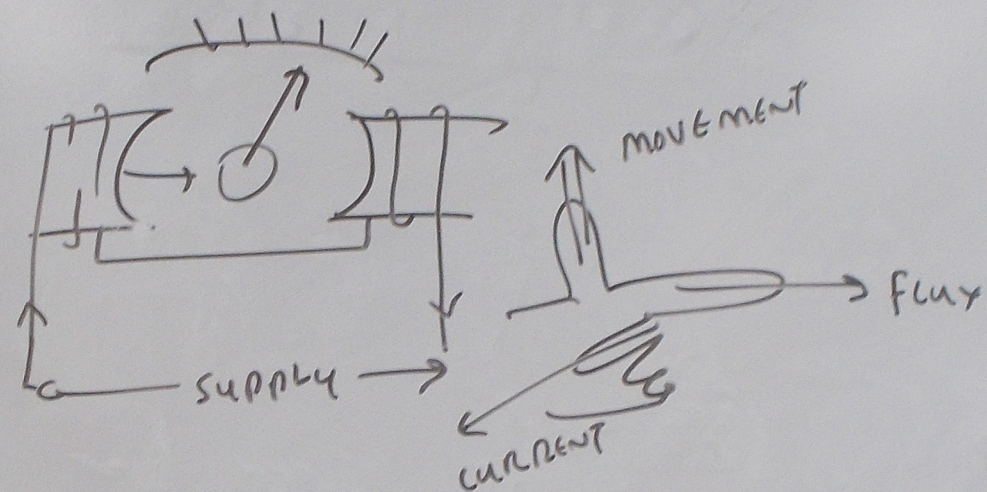
$$V_{PHASE} = \frac{V_{LINE}}{\sqrt{3}} = \frac{415}{1.732} = 240V$$



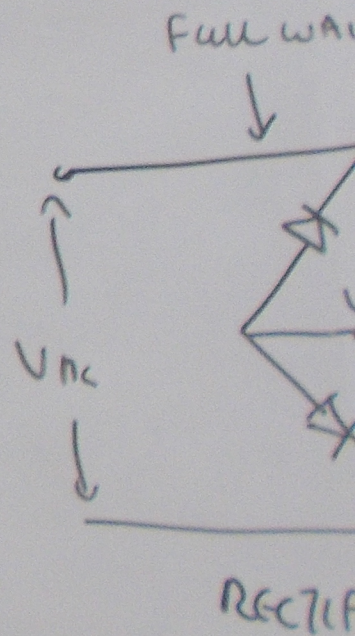
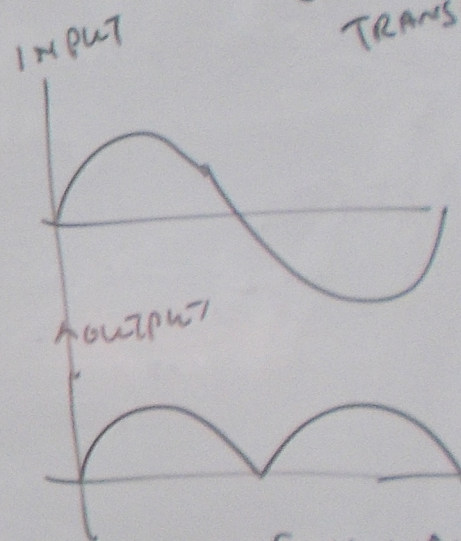
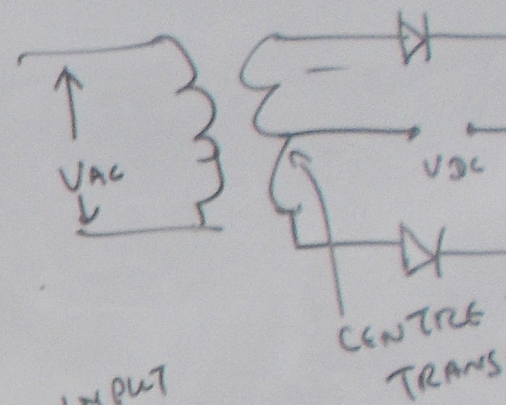
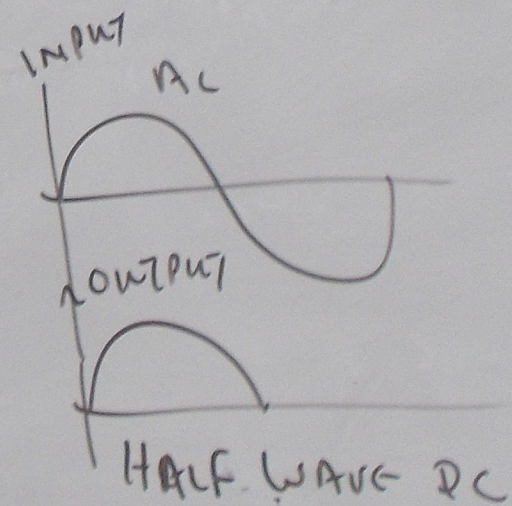
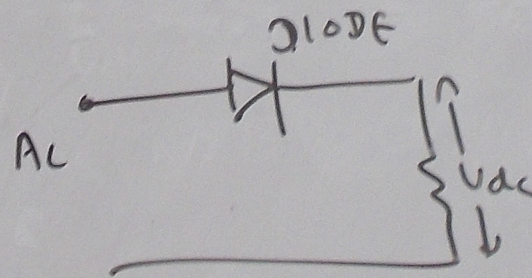
ANSWER (A)



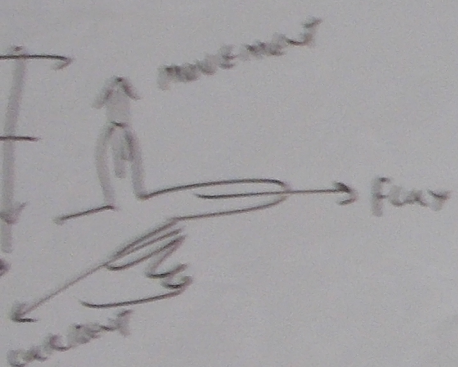
AC METER AND INSTRUMENT



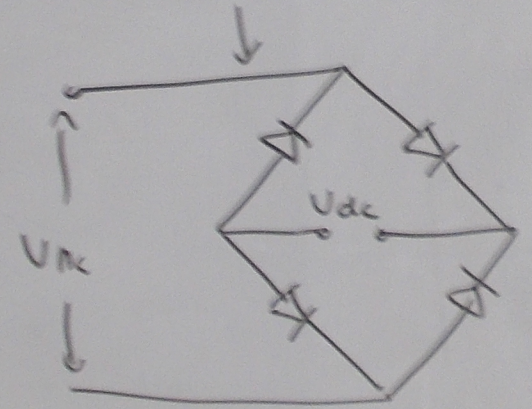
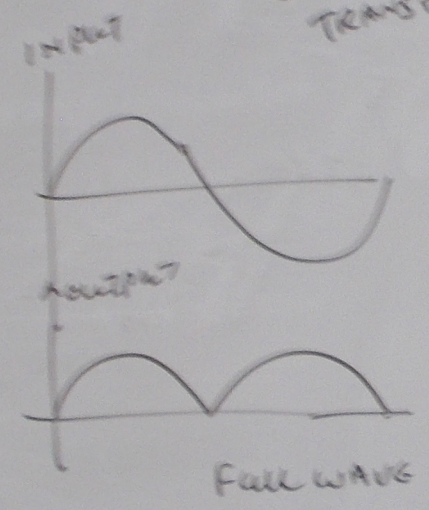
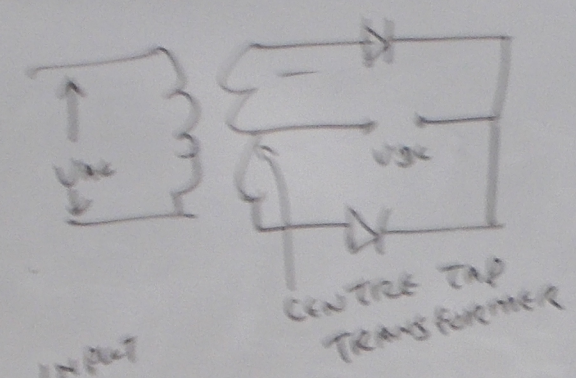
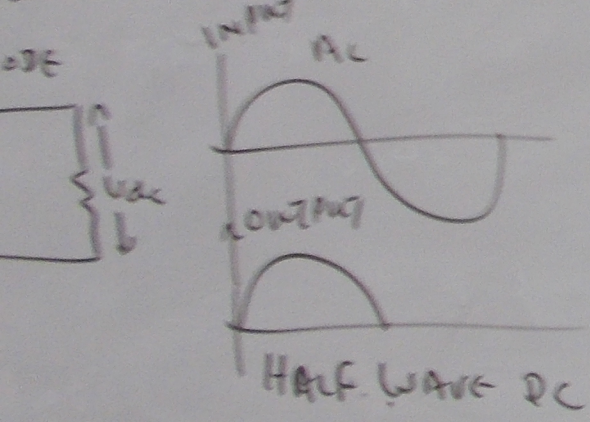
TO MEASURE AC CURRENT AND VOLTAGE,
IT NEEDS TO CONVERT AC TO DC.
TO SUPPLY TO METER.



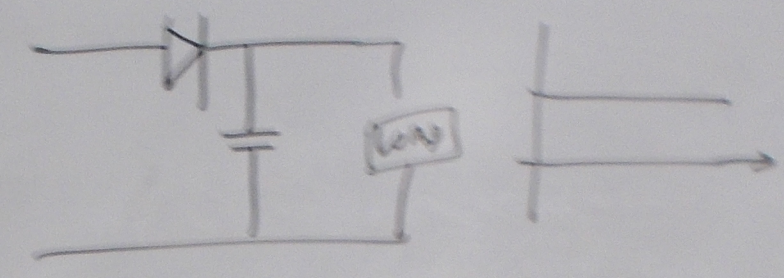
INSTRUMENT



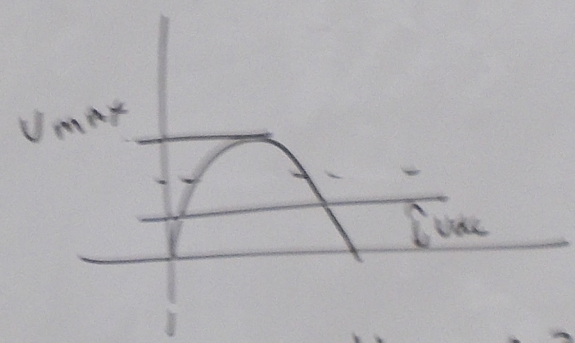
CURRENT AND VOLTAGE,
CONVERT AC TO DC.
TO METER.



RECTIFIER BRIDGE



DC IS FILTERED TO GET
PURE DC

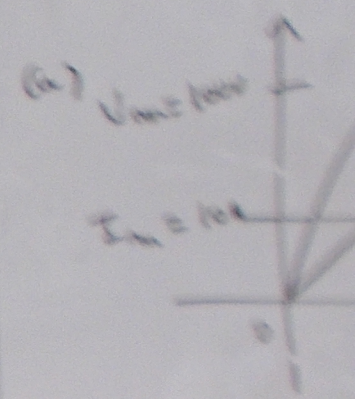


$$V_{dc} = 0.318 V_{max}$$

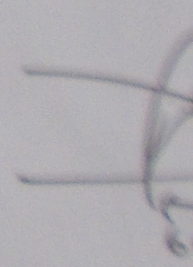
METER INDICATION = $1.11 \times V_{dc}$ (HALF WAVE)

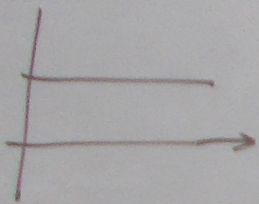
METER INDICATION = $2.22 \times V_{dc}$ (FULL WAVE)

THE VOLTAGE
SINUSOIDAL
IS 10V.



(b) V_{dc}





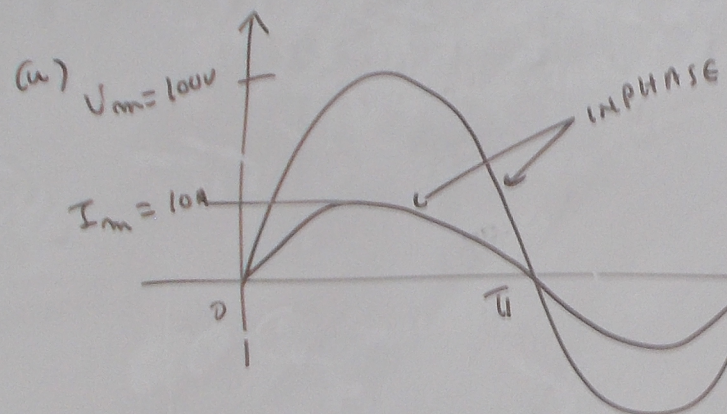
TO GET

18 V_{max}

$V = 1.11 \times V_{dc}$ (HALF WAVE)

$V_{rms} = 2.22 \times V_{dc}$ (FULL WAVE)

10) THE VOLTAGE ACROSS A RESISTOR IS INDICATED. FIND THE SINUSOIDAL EXPRESSION FOR THE CURRENT IF THE RESISTOR IS 10Ω . FIND THE CURVES FOR V AND I .

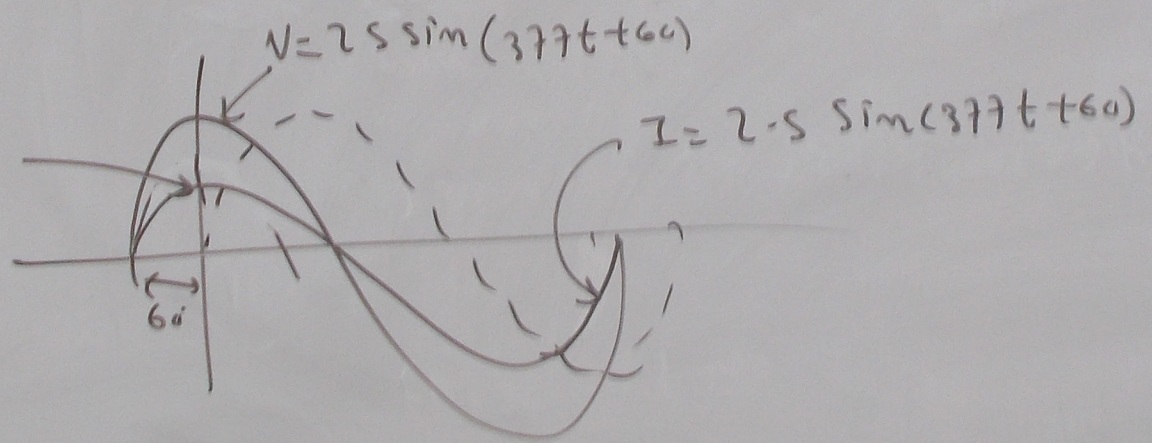


(a) $V = 100 \sin 377t$

(b) $I = 25 \sin (377t + 60^\circ)$

$I_m = \frac{V}{R} = \frac{100}{10} = 10A$

(b) $V_{max} = 25V$
 $R = 10\Omega$ $I_{max} = \frac{25}{10} = 2.5A$



11) THE CURRENT THROUGH A CAPACITOR IS INDICATED. FIND THE SINUSOIDAL EXPRESSION FOR THE VOLTAGE ACROSS THE CAPACITOR.

$I = 40$

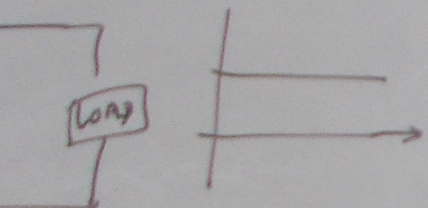
$I = 40$

$X_c = \frac{1}{2\pi fC}$

$I = \frac{V}{Z}$

$X_c = 0 - j2$

$V = I X_c$
 RMS



ALTERED TO GET

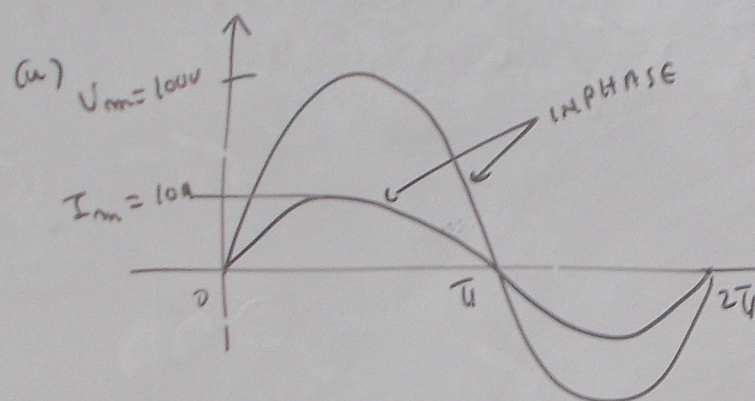
$\hat{V}_{dc}$

$$V_c = 0.318 V_{max}$$

$$INDICATION = 1.11 \times V_{dc} \text{ (HALF WAVE)}$$

$$INDICATION = 2.22 \times V_{dc} \text{ (FULL WAVE)}$$

pb THE VOLTAGE ACROSS A RESISTOR IS INDICATED. FIND THE SINUSOIDAL EXPRESSION FOR THE CURRENT IF THE RESISTOR IS 10Ω . FIND THE CURVES FOR V AND I .

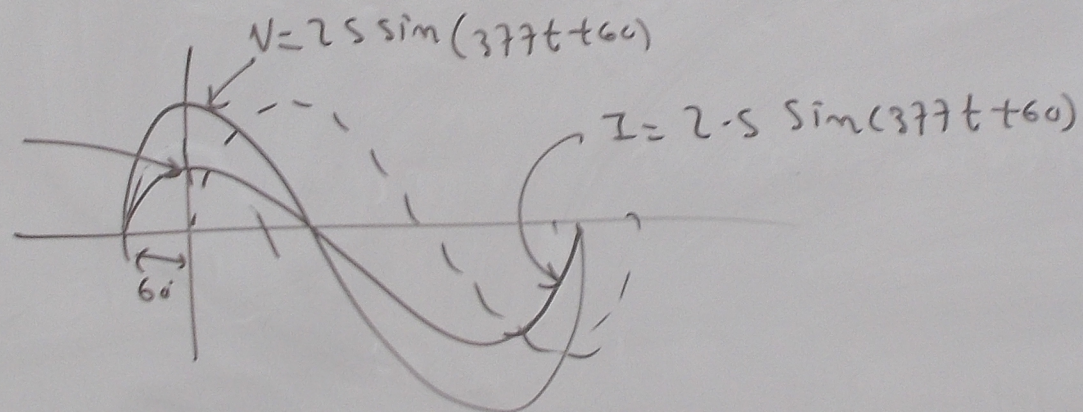


$$(a) V = 100 \sin 377t$$

$$(b) i = 25 \sin(377t + 60^\circ)$$

$$I_m = \frac{V}{R} = \frac{100}{10} = 10A$$

$$(b) \quad V_{max} = 25V \\ R = 10\Omega \quad I_{max} = \frac{25}{10} = 2.5A$$



pb THE CURRENT THROUGH THE CAPACITOR

$$I = 40$$

$$I = 40$$

$$X_c = \frac{1}{2\pi fC}$$

$$I = \frac{40}{\sqrt{2}}$$

$$X_c = 0 - j2$$

$$V = I X_c =$$

Q7) THE CURRENT THROUGH A $100 \mu F$ CAPACITOR IS GIVEN
FIND THE SINUSOIDAL EXPRESSION FOR THE VOLTAGE ACROSS
THE CAPACITOR

$$i = 40 \sin(500t + 60^\circ)$$

$$i = 40 \sin(\omega t + 60^\circ)$$

$$\omega = 500$$

$$\omega = 2\pi f = 500 \text{ RAD/S}$$

$$X_C = \frac{1}{2\pi f C} = \frac{1}{\omega C} = \frac{1}{500 \times 100 \times 10^{-6}}$$

$$= \frac{10^6}{50000} = 20 \Omega$$

$$I = \frac{40}{\sqrt{2}} \angle 60^\circ$$

$$X_C = 0 - j20 = 20 \angle -90^\circ$$

$$V_{RMS} = I \times X_C = \frac{40}{\sqrt{2}} \angle 60^\circ \times 20 \angle -90^\circ$$

$$= \frac{800}{\sqrt{2}} \angle 60 - 90$$

$$= \frac{800}{\sqrt{2}} \angle -30^\circ V$$

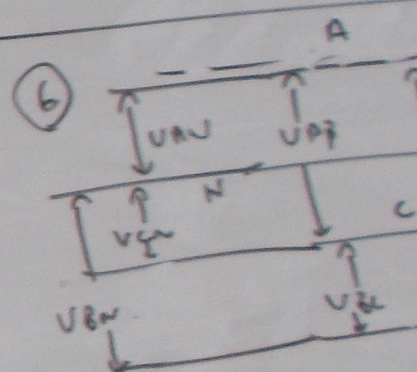
$$V_{MAX} = \sqrt{2} \times V_{RMS}$$

$$= \sqrt{2} \times \frac{800}{\sqrt{2}} \angle -30^\circ$$

$$= 800 \angle -30^\circ$$

$$V = 800 \sin(500t - 30^\circ)$$

⑤ TO REDUCE THE
WHICH CAUSE THE
IMPACTING ON THE
CURRENT DRAWN



V_{AB}, V_{BC}, V_{CA}
 V_{AN}, V_{BN}, V_{CN}

$$\vec{V}_{AB} =$$

$$\vec{V}_{BC} =$$

$$\vec{V}_{CA} =$$

Qb) THE CURRENT THROUGH A $100 \mu\text{F}$ CAPACITOR IS GIVEN
FIND THE SINUSOIDAL EXPRESSION FOR THE VOLTAGE ACROSS
THE CAPACITOR

$$i = 40 \sin(500t + 60^\circ)$$

$$i = 40 \sin(\omega t + 60^\circ)$$

$$\omega = 500$$

$$\omega = 2\pi f = 500 \text{ RAD/S}$$

$$X_c = \frac{1}{2\pi f c} = \frac{1}{\omega c} = \frac{1}{500 \times 100 \times 10^{-6}}$$

$$= \frac{10^6}{50000} = 20 \Omega$$

$$I = \frac{40}{\sqrt{2}} \angle 60^\circ$$

$$= \frac{800}{\sqrt{2}} \angle -30^\circ \text{ V}$$

$$X_c = 0 - j20 = 20 \angle -90^\circ$$

$$U_{\text{MAX}} = \sqrt{2} \times U_{\text{RMS}}$$

$$= \sqrt{2} \times \frac{800}{\sqrt{2}} \angle -30^\circ$$

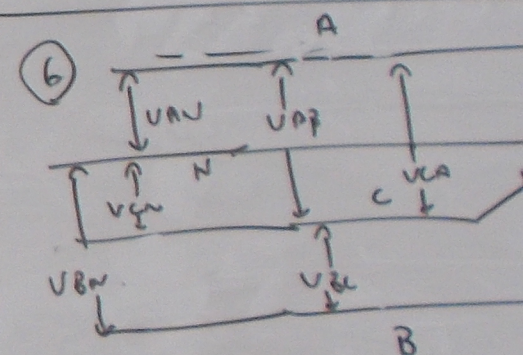
$$= 800 \angle -30^\circ$$

$$V = I X_c = \frac{40}{\sqrt{2}} \angle 60^\circ \times 20 \angle -90^\circ$$

$$= \frac{800}{\sqrt{2}} \angle 60-90$$

$$V = 800 \sin(500t - 30^\circ)$$

5) TO REDUCE THE REACT
WHICH CAUSE THE APPAR
IMPACTING ON THE ARMOR
CURRENT DRAWN FROM



$V_{AB}, V_{BC}, V_{CA} = \text{LINE}$
 $V_{AN}, V_{BN}, V_{CN} = \text{PHASE}$

$$\vec{U}_{AB} = \vec{U}_A + \vec{U}_B$$

$$\vec{U}_{BC} = \vec{U}_B + \vec{U}_C$$

$$\vec{U}_{CA} = \vec{U}_C + \vec{U}_A$$