جامعة الموصل / كلية الهندسة

قسم الهندسة الكهربائية

Subject Title: physics (الفيزياء)

Subject Code: ENGE 133

Class 1: General

Instructor : Hiba Nadhim Ameen Al- Kaoaz

Course Description (15 weeks) or Outlines

- Physics and Measurements, Forces and Motion
- Spring Forces and Hook’s Law
- Universal Gravitation
- Fluid Mechanics
- Bohr model
- Diodes and Applications
- Ohm’s Law, Power and Energy

Figures, Diagrams, or Examples…. etc

EX (a) Calculate the net force on the object of Figure 3. Give the magnitude of the net force and the angle it makes with the direction of $\vec{F}_1$.

(b) If the mass of the block is 20 kg, what is the acceleration of the mass? (Assume no other forces, such as gravitation, are present.)

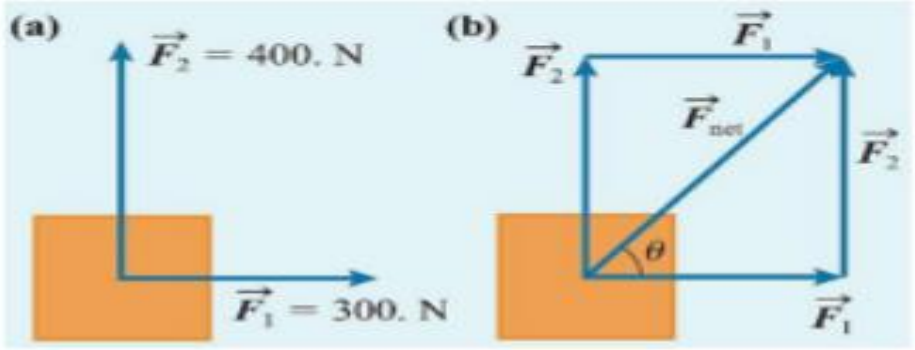


Fig. 3

Solution:

(a) The net force is obtained by the vector sum of the two forces.

$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2$

Since the forces act at 90^0 to each other, we can apply the Pythagorean theorem to find the magnitude of the net force:

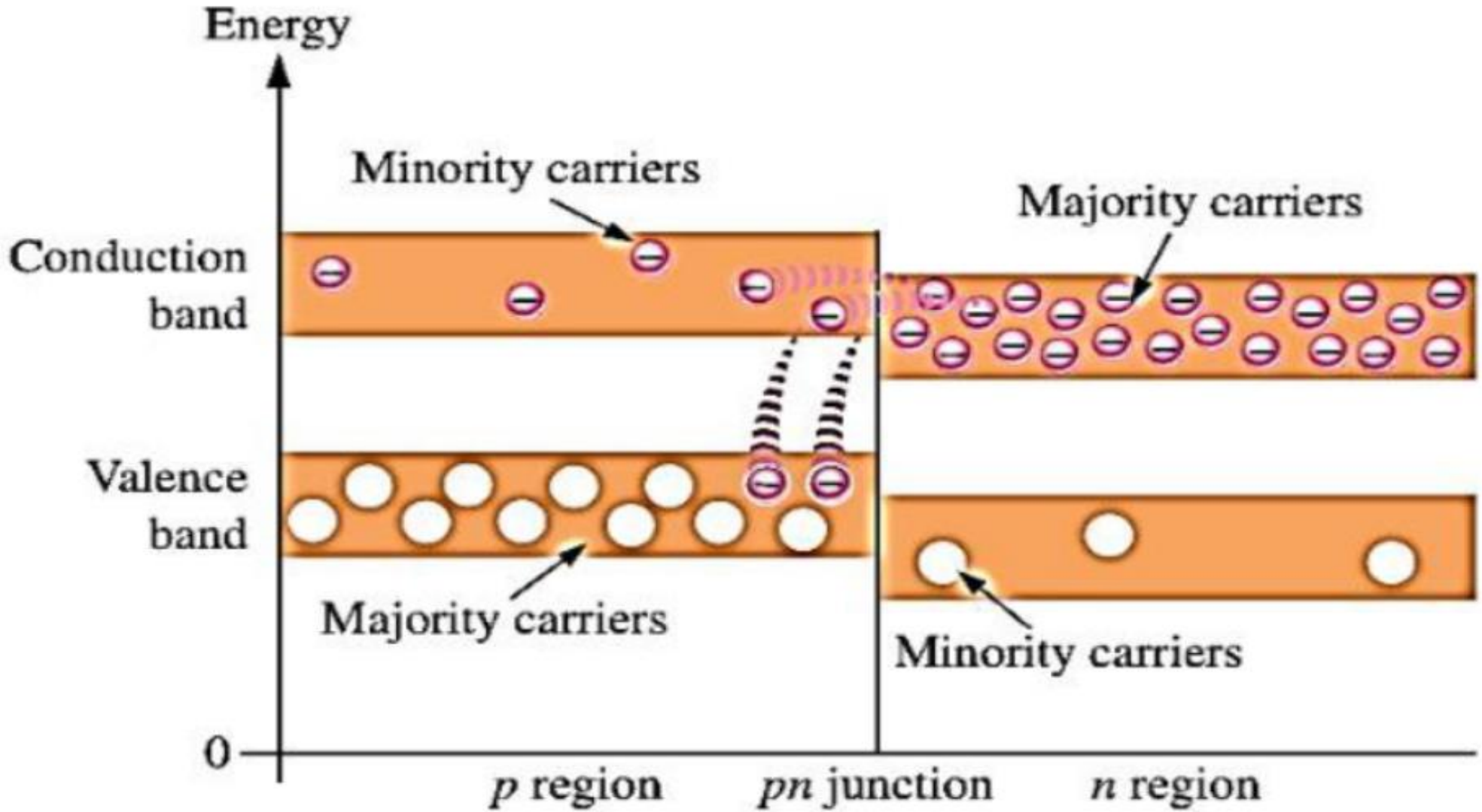
$$F_{net} = \sqrt{F_1^2 + F_2^2} = \sqrt{(300)^2 + (400)^2} = 500\ N$$

$$\theta = tan^{-1}\left(\frac{F_2}{F_1}\right) = tan^{-1}\left(\frac{400}{300}\right) = 53.13^0$$

(b) We can use Newton's second law to find the magnitude of the acceleration on the block:

$$a = \frac{F}{m} = \frac{500}{20} = 25\ \frac{m}{s^2}$$

Energy Diagram for a pn junction



Ex2 A 1500 kg car moving on a flat, horizontal road negotiates a curve, as shown in Figure 12(a). If the radius of the curve is 35 m and the coefficient of static friction between the tires and dry pavement is 0.5, find the maximum speed the car can have and still make the turn successfully.

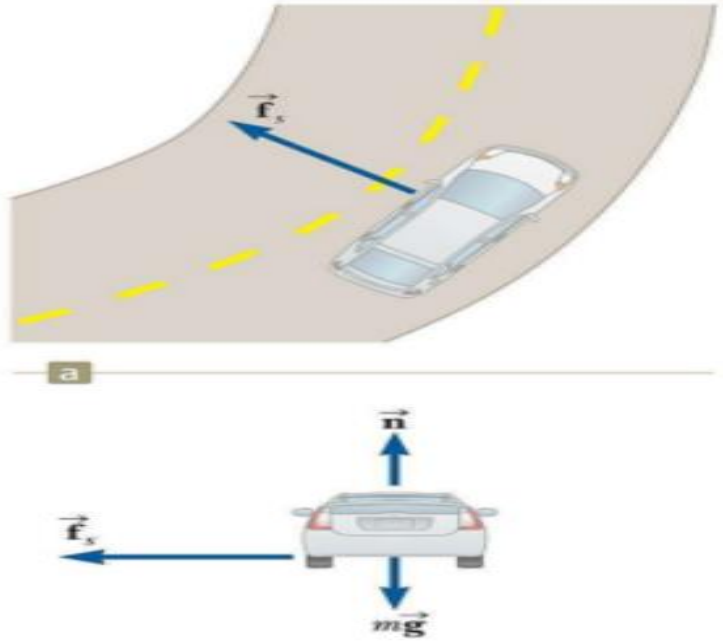


Fig. 12: (a) The force of static friction directed toward the center of the curve keeps the car moving in a circular path. (b) The free-body diagram for the car.

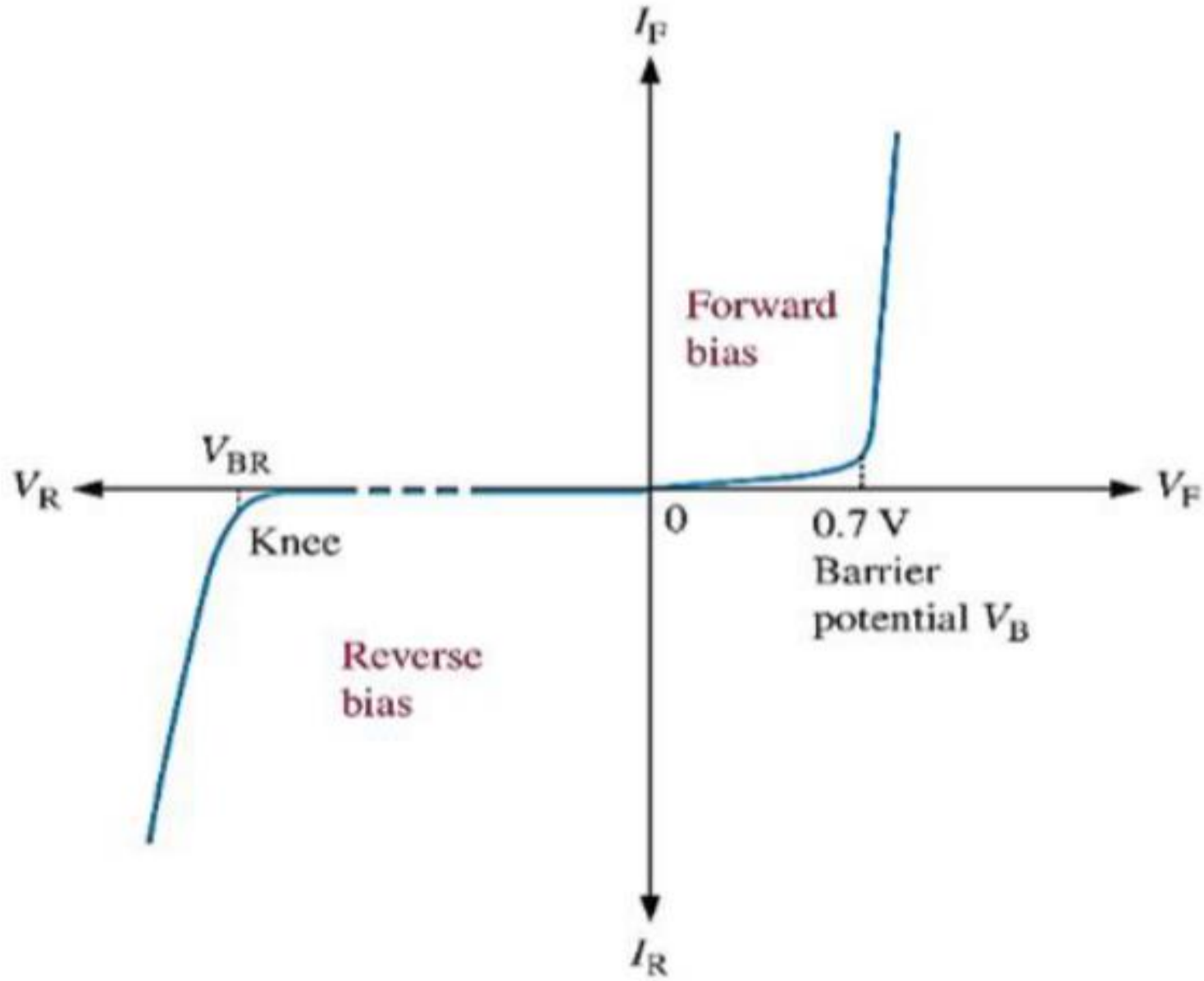
Solution:

The force that enables the car to remain in its circular path is the force of static friction. (*Static* because no slipping occurs at the point of contact between road and tires. If this force of static friction were zero for example, if the car were on an icy road the car would continue in a straight line and slide off the road).

$$f_s = m\frac{v^2}{r} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \qquad (1)$$

The maximum speed the car can have around the curve is the speed at which it is on the verge of skidding outward. At this point, the friction force has its maximum value $f_{s,max} = \mu_s n$. Because the car shown in Figure 12(b) is in equilibrium in the vertical direction, the magnitude of the normal force equals the weight ($n = mg$) and thus $f_{s,max} = \mu_s mg$. Substituting this value for f_s into Eq. (1), we find that the maximum speed is

$$v_{max} = \sqrt{\frac{f_{s,max}\,r}{m}} = \sqrt{\frac{\mu_s mgr}{m}} = \sqrt{\mu_s gr} = \sqrt{0.5 \times 9.81 \times 35} = 13.1\,\frac{m}{s}$$



The complete V-I characteristic curve for a diode.

Ex 3 a satellite of mass m moving in a circular orbit around the Earth at a constant speed v and at an altitude h above the Earth's surface, as illustrated in Figure 1 Determine the speed of the satellite in terms of G, h, R_E (the radius of the Earth), and M_E (the mass of the Earth).

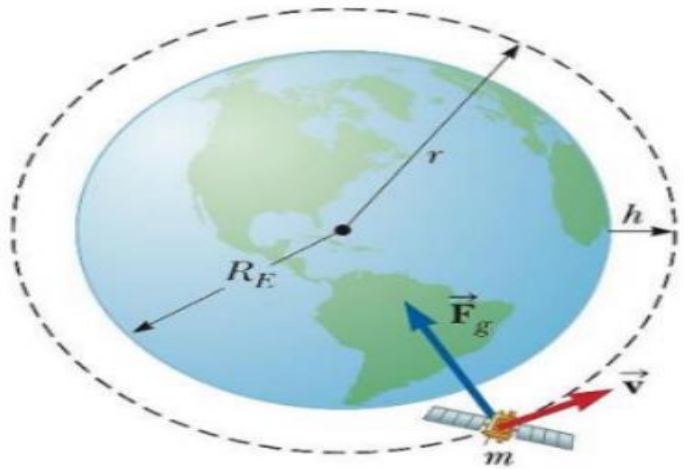


Figure 1 : A satellite of mass m moving around the Earth in a circular orbit of radius r with constant speed v.

Solution:

The net force on the satellite is the gravitational force

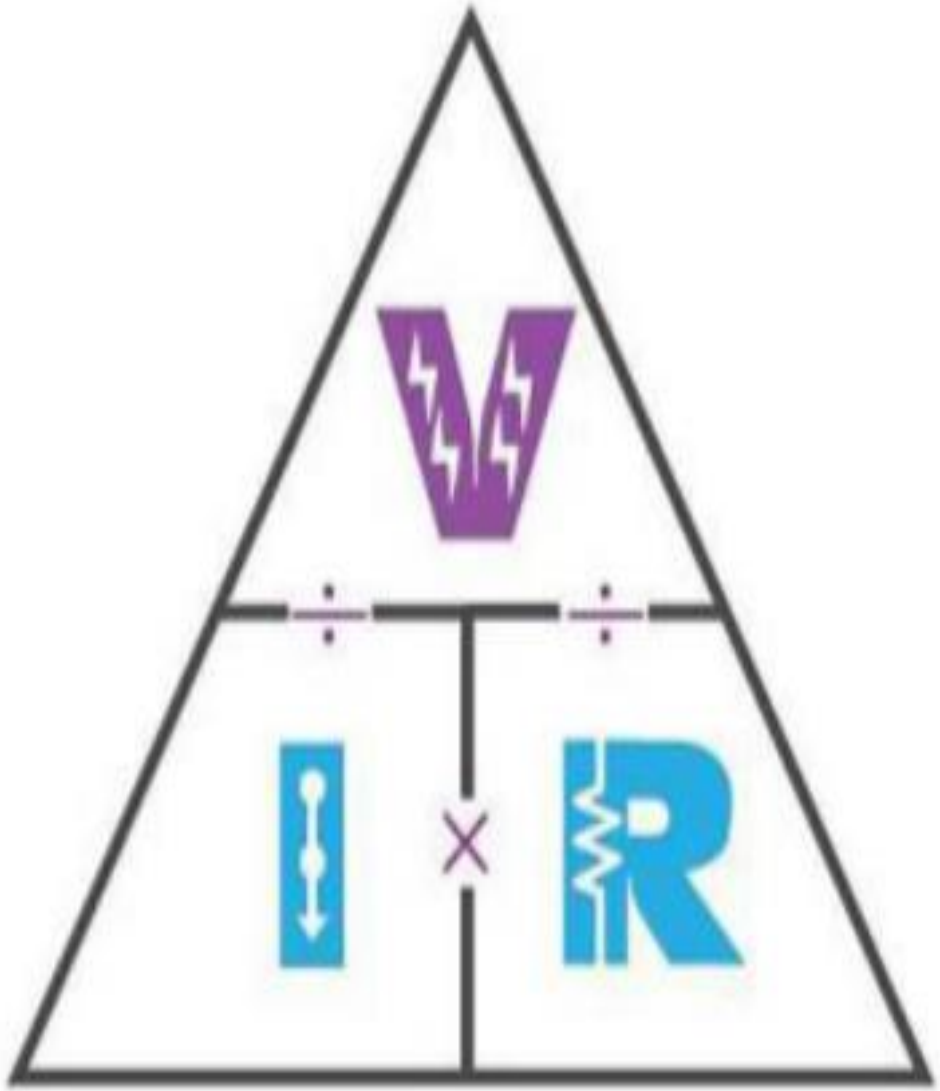
$$F_g = G\frac{M_E m}{r^2}$$

From Newton's second law and the fact that the acceleration of the satellite is centripetal, we obtain

$$G\frac{M_E m}{r^2} = m\frac{v^2}{r}$$

Solving for v and remembering that the distance r from the center of the Earth to the satellite is $r = R_E + h$, we obtain

$$v = \sqrt{\frac{GM_E}{r}} = \sqrt{\frac{GM_E}{R_E + h}}$$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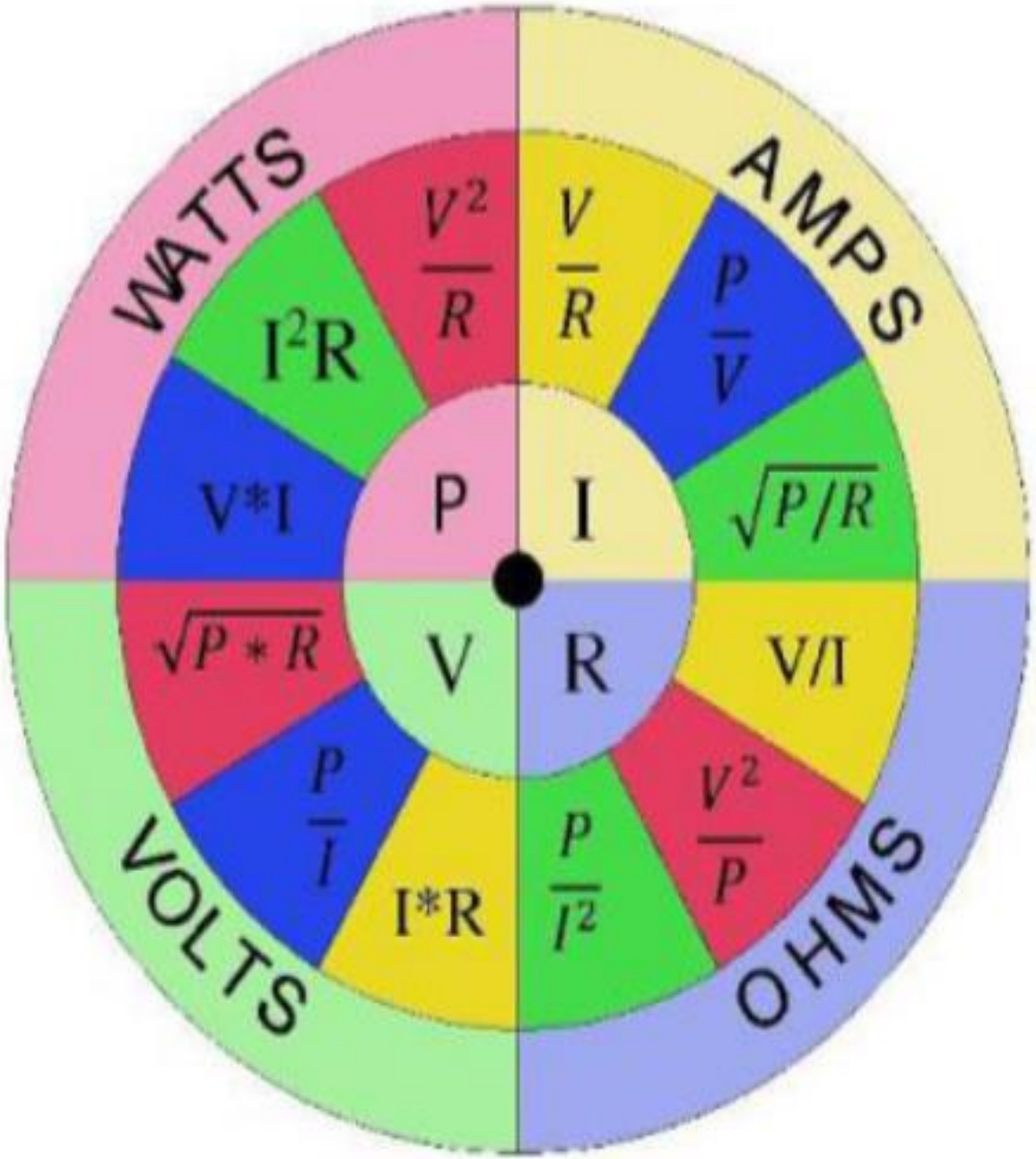
Ohm’s Law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I*R
$\frac{P}{I^2}$

TEXTBOOK OR REFERENCES

- Physics Science (McGraw , 2005)
- Physics Principles and Problems (McGraw , 2005)
- Physics for Scientists and Engineers (Serway Jewett ,6 Edition ,2004)

Useful Links

Description	Links
Video Lecture	https://www.youtube.com/playlist?list=PL08ef9eJxtJaL_80esaBbfavxr8XE3KDA
Math and Science	https://www.youtube.com/playlist?list=PLnVYEpTNGNtVbNcnrr8HoxXqPi6JBQMFa