S4 PYSICS TERM TESTS TERM 1

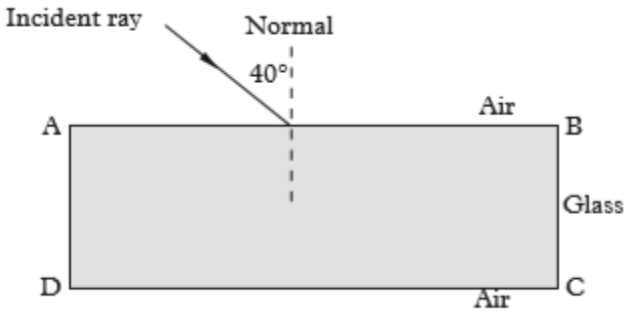
UNIT 1

1**. A light ray, with an angle of incidence of 35^0, passes from water to air. Find the angle of refraction using Snell's Law. Discuss the meaning of your answer.(refractive index of water is 1.33 , for air it is 1).**

2. Copy and complete using the word in bracket

A. When light passes from a more optically dense medium into a less optically dense medium, it will bend _____ (towards, away from) the normal.
B. When light passes from a less optically dense medium into a more optically dense medium, it will bend _____ (towards, away from) the normal.
C. When light passes from a medium with a high index of refraction value into a medium with a low index of refraction value, it wi away from ll bend _____ (towards, away from) the normal.

3. a Copy and complete the ray diagram to show the path of light through and out of the glass block of refractive index 1.50.



b) Calculate the angle of refraction in the glass block

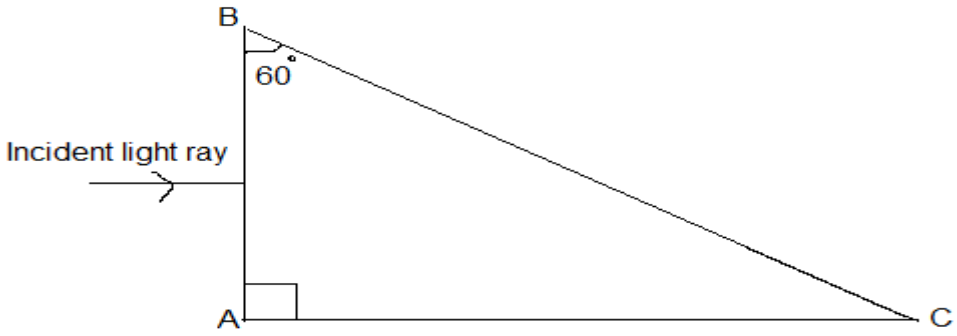
c) What will be the angle if refraction in the glass block if the angle of incidence equal to the critical angle.

4. A 1cm object AB is placed perpendicular to the principal axis of a convex lens of focal length 2 cm. Use ray diagram to find **graphically (**Don't use calculations)

a. the image position when the object is at a distance 4 cm from the lens .

b. image size
c. properties of the image

5. A light ray fall perpendicular to one of the face of a glass prism of angle 60° and refractive index 1.5 as shown below.



a. Copy the diagram and show how the light ray passes throughthe face AB

b. Determine the angle of incidence at the second face BC inside the prism

c. Determine the critical angle for this prism

d. What will happen to the incident ray at the face AB? Explain

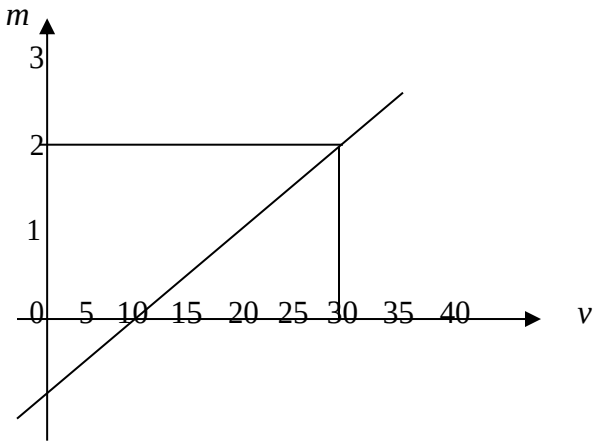
6. An object is placed 25 cm from a convex lens whose focal length is 10 cm. find the position and the nature of the image.

7. a) Write expressions for the power of a lens in terms of:

i) Refractive index and radii

ii) Magnification and image distance.

b) From the following graph of magnification against the image distance, determine the power and the focal length. ***/2marks***



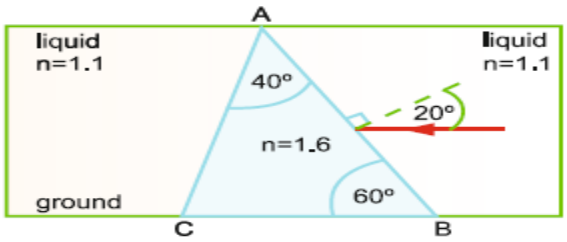
8. a. Define the term total internal reflection and give two conditions for the total internal reflection to occur.

b. Mention at least three illustrations of total internal reflection

c. On what principle optical fiber does works?
d. Explain why diamonds are cut with their sides flat and others slanting.

9. One convex lens and one concave lens are placed in contact with each other. If the ratio of their power is $\frac{2}{3}$ and the focal length of the combination is $30cm$. What are the values of individual focal lengths

10. A triangular glass prism (n = 1.6) is immersed in a liquid (n = 1.1) as shown in Fig. below A thin ray of light is incident as shown on face AB making an angle of 20° with the normal



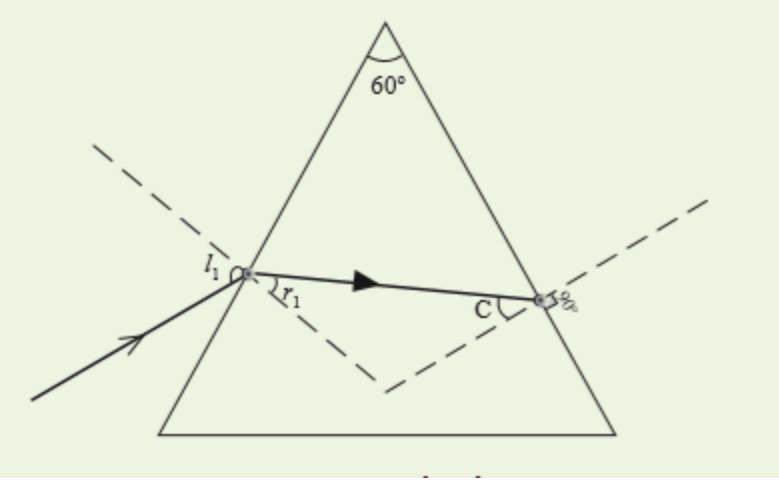
a. Which property of light used above.

b. Calculate the angle that the ray emerging from AC makes with the ground

c. What is the condition for minimum deviation to occur?

d. Determine the critical angle of the prism

11. A ray of light incident from air to a prism of refracting angle 60° grazes the boundary on the second face of the prism. Find the angle of incidence of the ray on the first face. (Take ng = 1.52).



12. A Bi-convex thin lens can be used as a simple "magnifier." It has a front surface with a radius of curvature of 20 cm and a rear surface with a radius of curvature of 15 cm. The lens material has a refractive index of 1.52. Answer the following questions to learn more about this simple magnifying lens.

a) What is its focal length in air?
b) What is its focal length in water (n = 1.33)?
c) Does it matter which lens face is turned toward the light?
d) How far would you hold an index card from this lens to form a sharp image of the sun on the card?

13. A lens has a convex surface of radius 20 cm and a concave surface of radius of 40 cm and is made of glass of refractive index 1.54. Compute the focal length of the lens, and state whether it is a converging lens or a diverging lens.

14. Two 28cm focal length converging lens are placed 16.5cm apart. An object is placed 36cm in front of one lens. Where will the final image formed by the second lens be located. What is the total magnification ?

15. Give reasons why prism rather than plane mirrors are used in periscopes and prism binoculars.

UNIT2: Optical instruments

1. a. Define the term optical instruments and give at least three examples

2. A particular nearsighted person is unable to see objects clearly when they are beyond 5 m away (the far point of this particular eye). What should the focal length be in a lens prescribed to correct this problem?

3. a.Differentiate accommodation of the eye from Resolving power of the optical instrument.

4. A slide projector projects an image of area $1m^2$ onto a screen placed 5m from the lens. If the are of the slide is $4m^2$. Calculate

a. The focal length of the projection lens

b. The distance of the slide from the lens

5. Magnification produced by astronomical telescope for normal adjustment is 20 and length of telescope is 105 c*m*. Find

a. Focal length of objective and eye piece of the telescope.

b. The magnification when image is formed at least distance of district vision (D=25cm)

c. Why telescopes made with eyepiece lens of short focal length compared to objective.

d. Why reflecting telescopes are more convenient than refracting telescopes?

e. What is the use of astronomical telescopes?

6 a) What is compound microscope used for?

b) The focal lengths of objective lens and eyepiece lens of a telescope are respectively f_o=100 cm and f_e =8 cm .

i) What is the telescope magnification when the eye is relaxed?

ii) Determine the length of the telescope.

c) Differentiate Light gathering of the eye from the eye ring.

7. Identify 3 main differences between astronomical telescope and compound microscope.

8. A compound microscope has an eye piece of focal length 5.0cm and an objective of focal length 3.2cm. If the distance between the objective and eyepiece is 22.0 cm, Calculate the magnifying power produced when the final image is at infinity.

9. A compound microscope consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by a distance of 15 cm. How far from the objective should an object be placed in order to obtain the final image at (a) the least distance of distinct vision (25 cm), and (b) at infinity? What is the magnifying power of the microscope in each case?

10. The focal lengths of the objective and the eye-piece of a compound microscope are 2.0 cm and 3.0 cm respectively. The distance between the objective and the eye-piece is 15.0 cm. The final image formed by the eye-piece is at infinity. The two lenses are thin. Determine the distances in cm of the object and the image produced by the objective measured from the objective lens are respectively

11. If an object subtend angle of 2° at eye when seen through telescope having objective and eyepiece of focal length $fo = 60\ cm$ and $fe = 5\ cm$ respectively. What is the angle subtend by image at eye piece.

12. A compound microscope has a magnifying power 30. The focal length of its eye-piece is 5 cm. assuming the final image to be at the least distance of distinct vision. What Magnification produced by the bjective lens.

13. Why the image formed by magnifying glass is free from chromatic aberration?

UNIT 3: MOMENT AND EQUILIBRIUM

1. Differentiate moment of a force from Equilibrium

2. a. What meant by scalar and vector quantity?

b. Identify scalar and vector quantities from the following: Momentum, Density, Acceleration, Torque and Temperature.

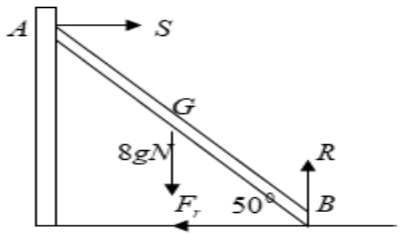
3. A man walks $2km$ due East from O to A and then $3km$ in a North-East direction from A to B. Find the distance of B from O, and describe the displacement $\overrightarrow{OB}$.

4. a. State and explain the conditions under which a rigid body is in equilibrium under the action of coplanar forces.

b. With a help of a diagram describe and explain the types of static equilibrium.

5. A uniform rod AB of mass 6kg and length 4 m is freely hinged at A to a vertical wall. The force P applied at B as shown in the diagram, keeps the rod horizontal and in equilibrium; R is the force of reaction at the hinge and θ is the angle that the line of action of this force makes with the vertical. Find the magnitude of the forces P and R and the angle

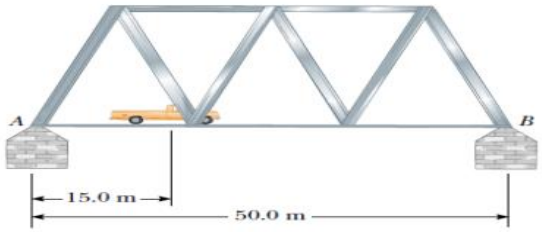
6. The diagram below shows a ladder AB of mass 8kg and length 6m resting in equilibrium at an angle of 50^0 to the horizontal with its upper end A against a smooth vertical wall and its lower end B on a rough horizontal ground, coefficient of friction μ.



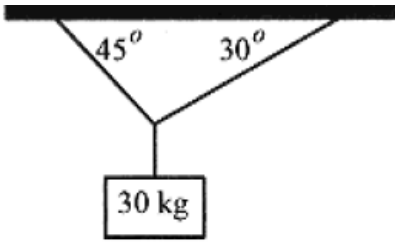
a. Name all the forces indicated in the free body diagram above .

b. Find the forces S, F_r and R and the least possible value of μ if the centre of gravity G of the ladder is 1m from B.

7. A uniform bridge of length 50.0 m and mass 4.00 x10^4kg is supported on a smooth pier at each end as in Figure below. A truck of mass 3.00 x10^4 kg is located 15.0 m from one end. Draw a free body diagram and determine the forces on the bridge at the points of support A and B?



8. An object of mass 30kg is hung with ropes making angles of 30° and 45° as shown in figure below. Calculate the tension in the ropes. / **5marks**

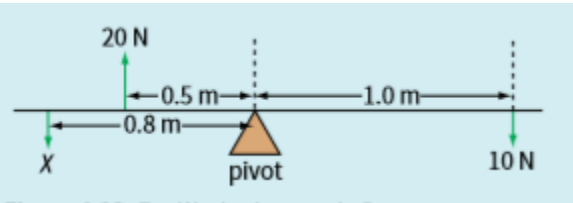


9. Consider a force, $\vec{F}$, with a magnitude, F, of 100 N acting in the *x*-*y* plane. This force acts at an angle, α, of 30^0 to *x*-axis. What is this force in component notation?

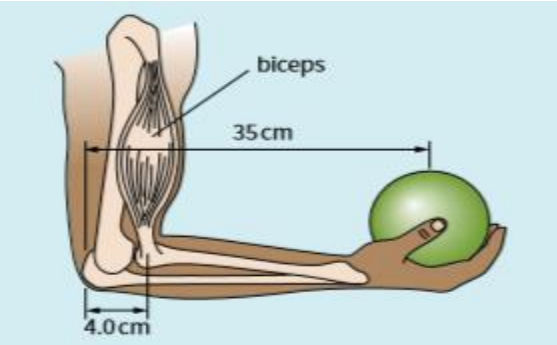
Solution

We can replace this force with a pair of forces acting along the *x*-axis and the *y*-axis as follows.

10. The beam below shown is in equilibrium. Determine the force X.

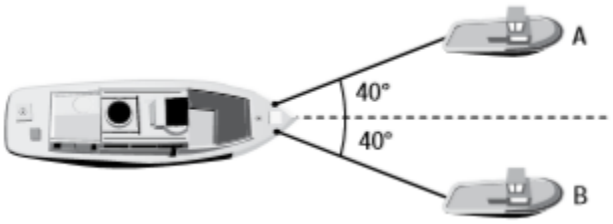


11. The figure below shows the internal structure of a human arm holding an object. The biceps are muscles attached to one of the bones of the forearm. These muscles provide an upward force



An object of weight 50 N is held in the hand with the forearm at right angles to the upper arm. Use the principle of moments to determine the muscular force F provided by the biceps. Given that the weight of forearm is 15 N, distance of biceps from elbow is 4.0 cm , distance of centre of gravity of forearm from elbow is 16 cm and the distance of object in the hand from elbow is 35 cm

12. A ship is pulled at a constant speed by two small boats, A and B, as shown in below. The engine of the ship does not produce any force.

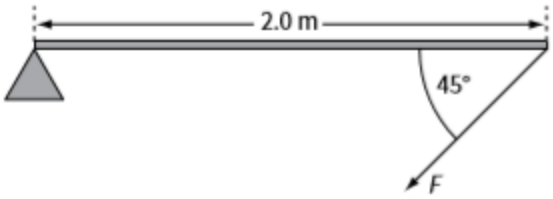


The tension in each cable between A and B and the ship is 4000 N.

a. Draw a free-body diagram showing the three horizontal forces acting on the ship.

b Draw a vector diagram to scale showing these three forces and use your diagram to find the value of the drag force on the ship.

13. The force F shown in Figure below has a moment of 40 N m about the pivot. Calculate the magnitude of the force F.



14.a. Explain what is meant by:

i. a couple

ii .torque.

b. The engine of a car produces a torque of 200 N m on the axle of the wheel in contact with the road. The car travels at a constant velocity towards the right (Figure 4.32).

i .Copy Figure 4.32 and show the direction of rotation of the wheel, and the horizontal component of the force that the road exerts on the wheel.

ii .State the resultant torque on the wheel. Explain your answer.

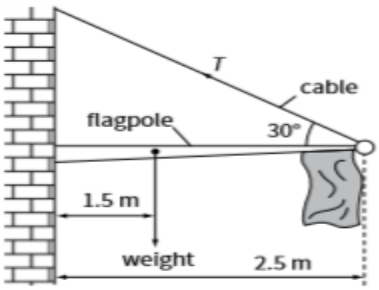
iii .The diameter of the car wheel is 0.58 m. Determine the value of the horizontal component of the force of the road on the wheel.

15. a . Explain what is meant by the centre of gravity of an object.

b A flagpole of mass 25 kg is held in a horizontal position by a cable as shown in Figure 4.33. The centre of gravity of the flagpole is at a distance of 1.5 m from the fixed end.

i. Write an equation to represent taking moments about the left -hand end of the flagpole. Use your equation to find the tension T in the cable.

ii Determine the vertical component of the force at the left -hand end of the flagpole.


T
cable
flagpole
30°
1.5 m
weight
2.5 m