Reflection, Refraction, Diffraction Learning Package

1. Key Terms Explained

A. Reflection

When a wave bounces off a surface. The angle of incidence equals the angle of reflection.

B. Refraction

When a wave changes speed and direction as it enters a new medium. Waves bend toward the normal when entering a slower medium and away from the normal when entering a faster medium.

C. Diffraction

When waves spread out after passing through a gap or around an obstacle.

2. The Normal

The normal is an imaginary line drawn at 90° to a surface where a wave hits it. It is used to measure angles of incidence, reflection, and refraction.

3. Reading Comprehension Passage

Waves behave differently when they meet surfaces or enter new materials. Reflection occurs when a wave bounces off a surface, such as light hitting a mirror. The angle at which the wave arrives equals the angle at which it leaves, and both angles are measured from the normal, an imaginary line drawn at 90° to the surface.

Refraction happens when a wave enters a new medium and changes speed, causing it to bend. When light enters a slower medium, such as moving from air into water, it slows down and bends toward the normal. This makes underwater objects appear shifted or bent. When light enters a faster medium, such as moving from water back into air, it speeds up and bends away from the normal. This explains why objects under water look bent upward when viewed from above.

There is also a special angle called the critical angle, which occurs when light travels from a slower medium to a faster one. At the critical angle, the refracted ray travels exactly along the boundary between the two materials. If the angle of incidence becomes larger than the critical angle, total internal reflection occurs — the wave reflects completely inside the medium instead of refracting out. This principle is used in optical fibres, endoscopes, and

many communication technologies.

Diffraction is the spreading of waves after they pass through a narrow gap or around an obstacle. Sound waves diffract easily, which is why you can hear someone even if they are standing behind a wall.

Understanding these behaviours helps scientists design lenses, sonar systems, optical fibres, and communication devices.

4. Vocabulary Session

Word	Meaning	Example
Reflection	Wave bouncing off a surface	Mirrors use reflection to form images.
Refraction	Wave bending due to speed change	A straw looks bent in water.
Diffraction	Wave spreading after a gap	Sound bends around corners.
Medium	Material a wave travels through	Light travels fastest in air.
Normal Line	Imaginary 90° line used to measure angles	Angles are measured from the normal.

5. Close-Ended Questions

1. Reflection occurs when a wave:
A. bends
B. spreads out
C. bounces off a surface
D. speeds up

2. Refraction happens because waves:
A. change speed
B. reflect
C. stop
D. increase frequency

3. Diffraction is greatest when:
A. gap ≫ wavelength
B. gap ≈ wavelength

C. gap ≪ wavelength
D. no gap exists

4. What stays equal during reflection?

5. Why does refraction occur?

6. What is the normal used for?

7. What happens to waves during diffraction?

6. Open-Ended Questions

8. Explain how refraction affects what we see underwater.

9. Describe a real-life example where diffraction is helpful.

10. Compare reflection and refraction using explanations.

11. Why is the normal important in wave diagrams?

12. Why is understanding wave behaviour important for designing optical devices?

7. Application Questions

13. A ray hits a mirror at 40°. Describe the reflected ray.

14. A straw looks bent in water. Which behaviour explains this?

15. Explain why you can hear someone even if you cannot see them.

16. Describe what happens when light enters a denser medium.

17. Describe how water waves behave through a narrow gap.

8. Answer Key

1. C
2. A
3. B

4. Angle of incidence = angle of reflection

5. Because waves change speed in a new medium

6. To measure angles accurately in reflection and refraction

7. Waves spread out after passing a gap or obstacle

8. Light slows down in water and bends, making objects appear shifted.

9. Diffraction helps sound travel around corners.

10. Reflection: bouncing off; Refraction: bending due to speed change.

11. The normal provides a consistent reference for measuring angles.

12. Lenses, cameras, and glasses rely on refraction and reflection.

13. Reflected ray = 40°

14. Refraction

15. Sound diffracts around the corner.

16. Light bends toward the normal.

17. Waves spread out due to diffraction.