HKDSE Essentials

Pearson Longman



Physics Exam Exercises Heat & Gases and Wave Motion

for Physics and Combined Science

With Special exercises for Radioactivity and Nuclear Energy

Yung Lit Hung



ALWAYS LEARNING

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S This icon indicates that the question is more difficult.





10. Molecular motion

Big Picture

- * p = force on wall per unit area
- * if const. vol., speed $\uparrow \Rightarrow$ hit the wall more vigorously \mathfrak{F} more frequently
- * if const. temp., volume $\downarrow \Rightarrow$ hit the wall more frequently



Rav Optics

Shoot-the-stars questions

Think and solve

 A light ray travels in a straight fibre of refractive index *n* and length *l*. What are the min. and max. time required for the light to travel from one end of the fibre to the other end without any light leak? (*c*: speed of light in vacuum)



	min.	max.
A.	l / (nc)	nl c
B.	ℓ / (nc)	$n^2\ell / c$
C.	nl / c	$n^2\ell$ / c
D.	nl / c	$n^4\ell / c$

2. A sphere with its back silvered can act as a retroreflector. When a fine beam of light is directed to the sphere as shown, it is refracted at the front surface, and focused on the rear interior surface. Then, it is reflected, and finally leaves the sphere in the incident direction. To achieve this, what is the approx. refractive index of the sphere?



- C. 2 D. 2.5
- **3.** A candle is placed at a fixed distance in front of a wall. A lens is inserted and moved slowly between them. At two particular positions, sharp images are formed on the wall. The heights of the images are 50 cm and 8 cm respectively. What is the height of the candle?

A.	6.25 cm	B.	20 cm
C.	21 cm	D.	29 cm

4. A triangular prism made of material X is used to deflect a light ray by 90° (i.e. incident ray \perp emergent ray) in water (n = 1.33).



- (a) What is the min. refractive index of *X*? (1 mark)
- (b) Sarah claims that she can deflect a light ray by 90° with a rectangular block made of material *Y*, whose refractive index is lower than *X*. Do you agree? Illustrate you explanation with the aid of a diagram. (4 marks)

Think and solve (For full-X physics only)

5. Jack sets up the following apparatus to determine the refractive index *n* of a liquid. The tank is half-filled with the liquid. A parallel laser beam is directed perpendicularly onto a grating which is attached to one side of the tank as shown. The screen on the opposite side is used to catch the diffracted fringes produced by the grating.



The angular separation between the first order fringes above the liquid surface is 40° while that below the liquid is 30° . Which of the following best estimates the value of *n*?

- A. sin 20°/sin 15°
- B. sin 40°/sin 30°
- C. sin 70°/sin 65°
- D. sin 80°/sin 60°

Ray Optics

6. A square box of length 2*d* has a small rotating mirror in the middle. A laser beam is directed onto the centre of the mirror, and produces a bright spot on the wall of the box.



If the mirror rotates at an angular speed ω , what is the max. sweeping speed of the spot on the wall? (Hint: if the box is circular, where will the spot sweep the fastest?)

A.	ωd	В.	$2\omega d$
C.	$2\sqrt{2}\omega d$	D.	$4\omega d$

6. Ken places a toy *O* in front of a lens *L*. He then places a screen *S* behind the lens as shown. The screen captures a sharp and diminished image.

Now he wants a sharp and magnified image. With the position of L fixed, what should he do?

- A. Move both *O* and *S* away from *L*.
- B. Move both *O* and *S* towards *L*.
- C. Move O away from L but S towards L.
- D. Move O towards L but S away from L.

E. From-a-diagram

- 1. A pin *O* is placed in front of a plane mirror *M* and forms an image *I* as shown. *M* is now moving away from *O* at 4 cm s⁻¹. What is the speed of *I*?
 - A. 2 cm s^{-1} B. 4 cm s^{-1}
 - C. 8 cm s^{-1} D. 16 cm s^{-1}
- A light beam strikes on a convex lens as shown. The foci of the lens are *F* and *F'*.Which of the following paths best represents the refracted ray?
 - A.
 P
 B.
 Q

 C.
 R
 D.
 S
- **3.** In a ripple tank, a series of water waves travel towards a deeper region *Q* as shown.

Which of the following diagrams best shows the wave pattern on the right of *Q*?



4. The diagram shows a light ray travelling through a glass prism.

What is the refractive index of the glass?

А.	0.66	В.	1.43
C.	1.52	D.	1.74

5. The figure shows a light ray travelling from air to medium *W* and another light ray which travels from *W* to air.

What is the angle $\theta?$

А.	36.7°	В.	41.7
C.	48.3°	D.	53.3



Skill-sharpening Exercises









A4. Finding particle motion in a wave

Exercise 1 (W1, 1 min)

In each question, determine the direction of motion of particles A to D of a **TRAVELLING** transverse wave at the moment shown.







Exercise 2 (W1, 1 min)

In each question, determine the direction of motion of particles *A* to *D* of a **STATIONARY** transverse wave at the moment shown.



 $A (\uparrow / \downarrow / - momentarily at rest (0))$



A6. Handling refracted rays

Exercise 1 (W4, 0.5 min)

In each case, determine which line best represents the refracted ray. Given n_{water} = 1.33 and n_{glass} = 1.5.







4.









a/b

a/b



a/b









Exercise 2 (W4, 0.5 min)

In each case, determine which line best represents the refracted ray.



Revision Exercises

Radioactivity and Nuclear Energy

(For full-X physics only)



Categories:

- Characteristics of ionizing radiation
- Atomic model and decay series
- Half-life and exponential decay
- Nuclear energy

Level of difficulty:

Unless otherwise specified, take $c = 3.00 \times 10^8$ m s⁻¹, $e = 1.60 \times 10^{-19}$ C, u = 931 MeV = 1.661×10^{-27} kg.

A. Multiple-choice questions

Characteristics of ionizing radiation

1. The ionizing power of the three types of nuclear radiation, in ascending order is

Α.	α, β, γ.	В.	α, γ, β
C.	β, γ, α.	D.	γ, β, α

2. The diagram shows the cloud chamber tracks of a radioactive source.



The source is emitting

- A. α radiation.
- B. β radiation.
- C. γ radiation.
- D. X-rays.

3. A certain radioactive source gives a corrected count rate of 300 counts per minute. When different absorbers are put in between, the corresponding corrected count rates are recorded. The following table shows the results.

Absorber	Corrected count rate / counts min ⁻¹		
Paper	80		
3 mm aluminium sheet	76		
20 mm lead block	30		

Based on the above result, the radioactive source emits

A.	α only.	В.	β only.
C.	α and β only.	D.	α and γ only