FUKIEN SECONDARY SCHOOL

S3 First Term Examination (2020-2021)

Physics

(45 minutes)

Date: 14th January 2021 Name: _____

Time: 8:30 a.m. – 09:15 a.m. Class: _____ No.: ____

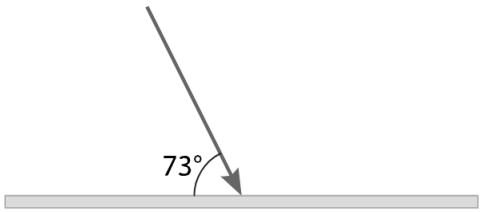
Instructions to students:

1. Write your name, class and class number on both the question paper and the answer sheets.
2. Answer ALL questions.
3. Write down all the answers on the answer sheets.
4. Hand in the question paper and the answer sheets at the end of the examination.
5. The total mark of the paper is 60.
6. The paper consists of two sections: Section A Multiple Choice Questions (20 marks) and Section B Structured Questions (40 marks).

Section A: Multiple Choice Questions (20 marks)

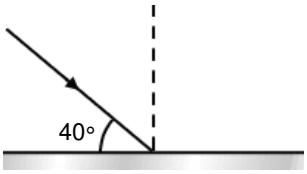
1. Which of the following statements about reflection are correct?
   (1) When a parallel beam of light falls on a rough surface, the reflected beam is not parallel.
   (2) The reflection of light on a rough surface does not obey the laws of reflection.
   (3) No clear image can be formed by a rough surface where light undergoes diffuse reflection.
   A. (1) and (2) only
   B. (1) and (3) only
   C. (2) and (3) only
   D. (1), (2) and (3)

2. A ray of light falls on a horizontal plane mirror as shown in the figure below. What is the angle of incidence?



   A. 17°
   B. 27°
   C. 37°
   D. 73°

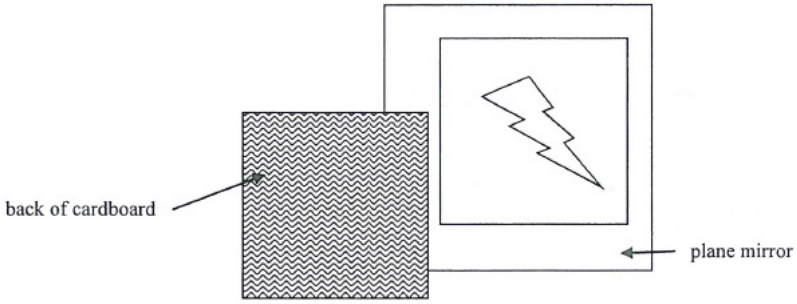
3. A ray of light falls on a horizontal plane mirror as shown in the figure below.



In order to reflect the light ray vertically upwards, the plane mirror should be rotated by

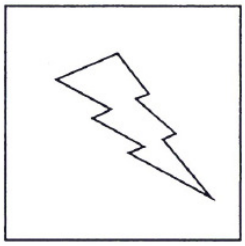
A. 10°.
B. 20°.
C. 25°.
D. 50°.

4. The figure below shows the image seen when a plane mirror is placed in front of a cardboard with a design on its front surface.

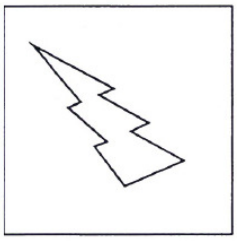


Which diagram below shows the design on the cardboard?

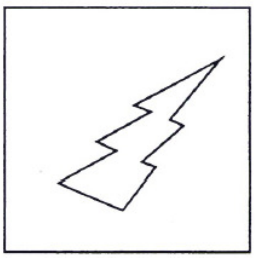
A.



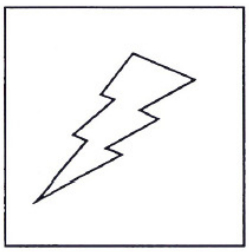
B.



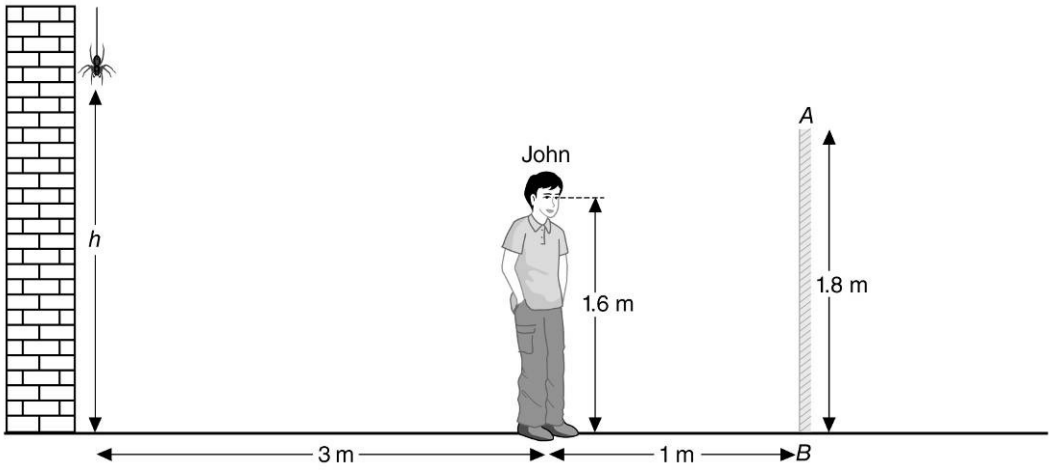
C.



D.



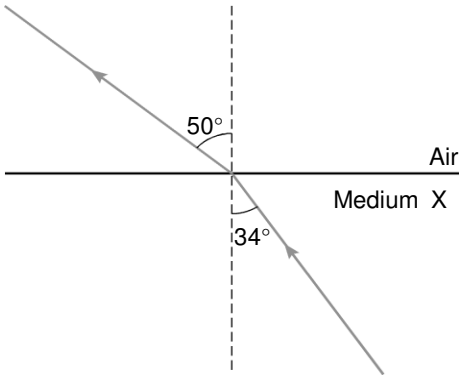
5. John stands in front of a vertical plane mirror *AB*, where point *A* is 1.8 m above the ground (see the figure below). John's eye is 1.6 m above the ground and 1 m from the mirror. Looking into the mirror, he can see a wall 3 m behind him.



A spider is moving down on the wall. What is the maximum height *h* of the spider that John can see its image in the mirror?

A. 2.0 m
B. 2.2 m
C. 2.4 m
D. 2.6 m

(For questions 6 - 7) The figure below shows a light ray travelling from medium *X* to air.



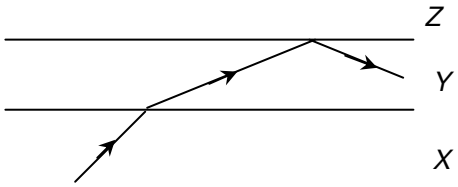
6. What is the refractive index of medium *X*?

A. 0.68
B. 0.73
C. 1.37
D. 1.47

7. Take the speed of light in air to be 3×10^8 m s^{-1}. What is the speed of light in medium *X*?

   A. 2.04×10^8 m s^{-1}
   B. 2.19×10^8 m s^{-1}
   C. 2.30×10^8 m s^{-1}
   D. 4.11×10^8 m s^{-1}

8. The figure below shows a light ray travelling from *X* towards *Z*. The refractive indices of mediums *X*, *Y*, *Z* are n_X, n_Y and n_Z respectively.

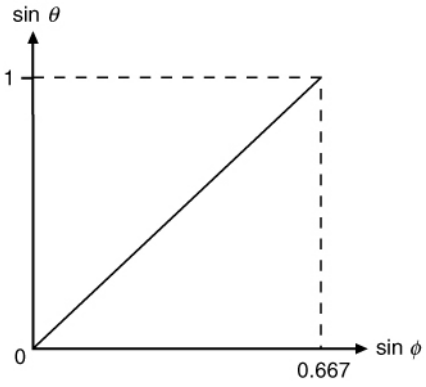


   Which of the following is/are correct?

   (1) $n_X > n_Y$
   (2) $n_Y < n_Z$
   (3) $n_Z > n_X$

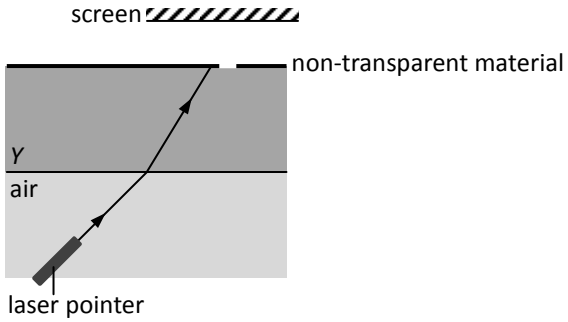
   A. (1) only
   B. (2) only
   C. (1) and (3) only
   D. (2) and (3) only

9. A beam of light travels from air to another medium *X*. The graph below shows the relation between sin θ and sin ϕ, where θ is the angle of incidence and ϕ is the angle of refraction. What is the refraction index of *X*?



   A. 0.667
   B. 1.00
   C. 1.50
   D. 2.25

10. In the figure below, a laser beam travels from air to medium *Y* and it is then blocked by a thin layer of non-transparent material floating on medium *Y*.



There is a small opening on the layer of the non-transparent material. Which of the following actions can be taken so that the laser beam may reach the screen by leaving medium *Y* through the opening? Assume that the position and the orientation of the laser pointer remain unchanged.

(1) Increasing the refractive index of medium *Y*.
(2) Decreasing the refractive index of medium *Y*.
(3) Increasing the thickness of medium *Y*. In this case, the non-transparent material moves vertically upwards accordingly.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

- End of Section A -

Section B: Structured Questions (40 marks)

1. Speed of light is 3×10^8 m s^{-1}. Write THREE other properties of light. (3 marks)

2. As shown in Figure 1 on the answer sheet, Tony is standing 2 m in front of a shop window. A poster of width 3 m is 4 m away from the shop window. Assume that Tony's eyes can be treated as a point.

   (a) Draw the poster's image in Figure 1 on the answer sheet. (1 mark)
   (b) Draw two light rays to show how Tony sees the poster through the shop window in Figure 1 on the answer sheet. (2 marks)

3. As shown in Figure 2 on the answer sheet, Jerry and Tom are playing hide-and-seek. At the instant shown, Tom is hiding behind an opaque board such that Jerry cannot see him in the mirror.

   (a) In which direction, *A* or *B*, should Jerry move if he wants to see Tom in the mirror? (1 mark)

   (b) Jerry moves to a position that he can **just** see Tom. Label the new location of jerry as '×' and draw a light ray to show how Jerry just sees Tom in Figure 2 on the answer sheet. (2 marks)

   (c) What is the minimum distance that Jerry has to travel? (3 marks)

4. In a convenience store, Snowden of 1.8 m tall stands between a wall and a goods shelf as shown in Figure 3 on the answer sheet. A plane mirror is mounted on the wall 3.4 m above the ground with an angle 45° to the vertical.

   (a) Draw the image of the Snowden in the mirror. (2 marks)

   (b) Mary, the shopkeeper, stands at the right side of the goods shelf. Given that Mary can see Snowden's head in the mirror. If Snowden is wearing a hat with a hidden camera installed on its top, can the camera capture Mary's image in the mirror? Explain briefly. (2 marks)

5. A ray of light travels from air to medium *X* as shown in Figure 4 below.

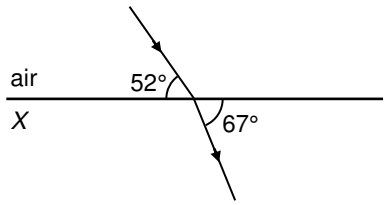


Figure 4

   (a) Find the angle of incidence. (1 mark)

   (b) Find the angle of refraction. (1 mark)

   (c) Find the refractive index of *X*. (2 marks)

   (d) Find the critical angle of light rays travelling from *X* to air. (2 marks)

6. What will happen when light travels from medium 1 to medium 2? Explain your answer. (4 marks)

   (A) Bend towards the normal

   (B) Bend away from the normal

   (C) Total Internal Reflection

	Medium 1 (refractive index)	Medium 2 (refractive index)	Angle of incidence
(a)	Water (n = 1.33)	Glass (n = 1.5)	60°
(b)	Glass (n = 1.5)	Diamond (n = 2.42)	40°

7. Figure 5 below shows how a beam of light travels through a 60°–60°–60° plastic prism in air.

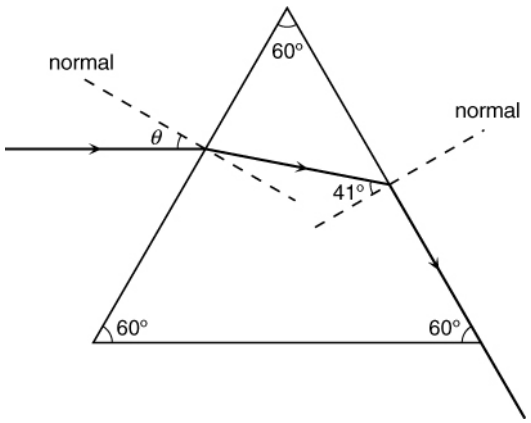


Figure 5

(a) What is the refractive index of the plastic? (2 marks)

(b) Find the angle θ. (3 marks)

(c) Another light ray *X* has angle of incidence smaller than θ. Complete the path of *X*. (3 marks)

8. Alex tries to catch a fish in the water using a spear. His experience tells him that he should not aim at the position where the fish appears to be.

(a) Draw a diagram in Figure 6 on the answer sheet to illustrate the observed location of the fish. (4 marks)

(b) Use the answer of part (a) to explain Alex's idea. (2 marks)

End of Section B

END OF PAPER