

Class	Register Number	Name
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南洋女子中学校
NANYANG GIRLS' HIGH SCHOOL
End-of-Year Examination 2017
Secondary Three

ADVANCED PHYSICS

Paper 1 Multiple Choice

Monday

9 October 2017

45 minutes

08:45 – 09:30

Additional materials: Optical Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name, register number and class in the spaces at the top of this page.

Do not use staples, paper clips, highlighters, glue or correction fluid on the Multiple Choice **Optical Answer Sheet** (OAS) provided.

Write in soft pencil your name, class and register number on the Optical Answer Sheet.

There are **thirty** questions in this paper. Answer **all** questions. For each question there are four possible answers, **A, B, C** and **D**. Choose the **one** you consider correct and shade the lozenge of your choice in **soft pencil** on the Optical Answer Sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

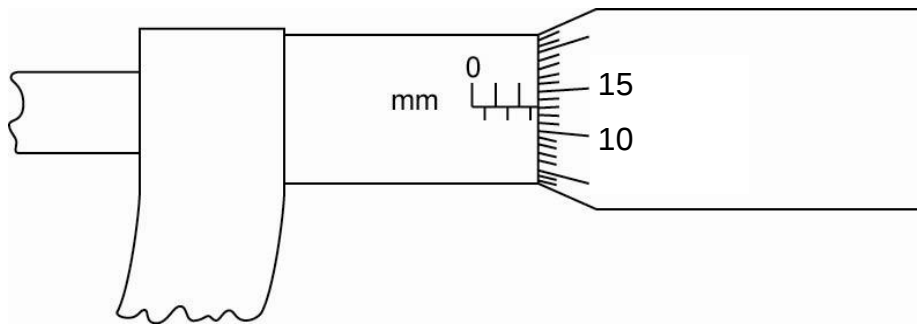
The use of an approved scientific calculator is expected, where appropriate.

Any rough working should be done in this booklet.

The acceleration due to gravity (or gravitational field strength) g is taken to be 10 m s^{-2} (or 10 N kg^{-1}) near the Earth's surface.

Given formulae:
$$\text{impulse} = F \Delta t = mv - mu$$

- 1 What is the reading shown on the micrometer screw gauge?



- A 2.13 mm B 3.13 mm
C 2.63 mm D 5.13 mm

- 2 A student uses a spring balance to measure the weight of an object hanging from it. The spring balance is marked every 0.2 N but has a zero error of 0.4 N. The student is not aware of this zero error and writes down a reading of 1.5 N. Is the reading accurate and is it measured to the correct precision of the instrument?

	accurate	precise
A	no	no
B	no	yes
C	yes	no
D	yes	yes

- 3 Which of the following is a **scalar** quantity?

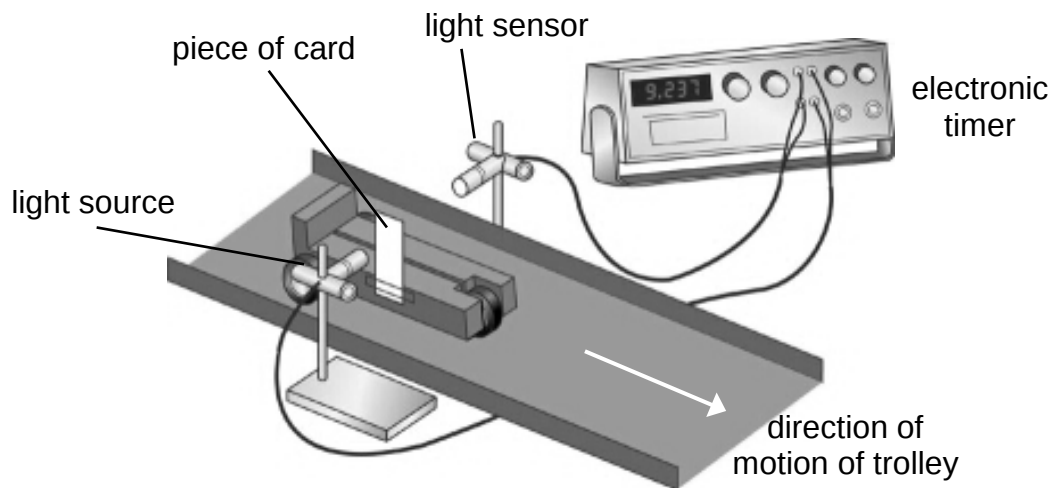
- A The displacement of a moving bus.
B The tension in a cable supporting a lift.
C The normal contact force on a rolling ball.
D The liquid pressure on a diver underwater.

- 4 A bird flies 3.0 km due west and then 2.0 km due north. What is the magnitude of the bird's displacement?

- A 2.0 km B 3.0 km C 3.6 km D 5.0 km

- 5** In an experiment, a light gate is set up (with a light source and light sensor) connected to an electronic timer.

A trolley with a piece of card of width 5.0 cm passes through the light gate in 0.25 s.



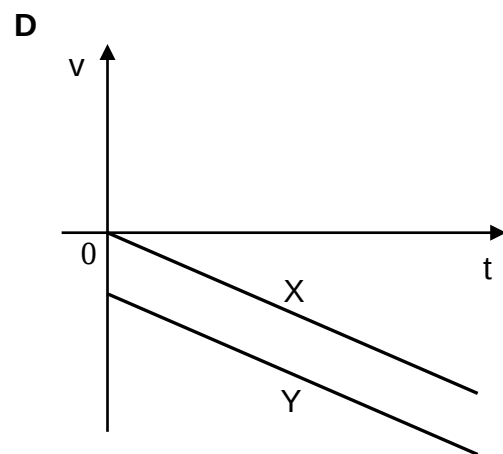
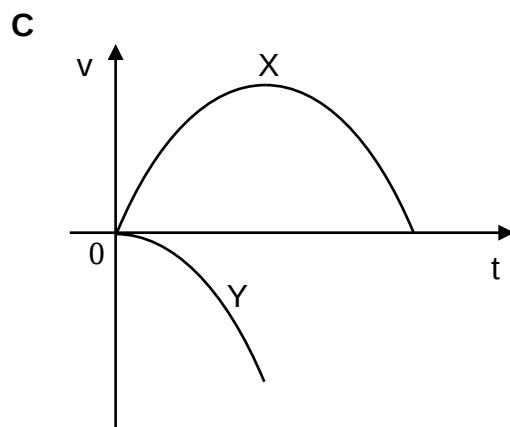
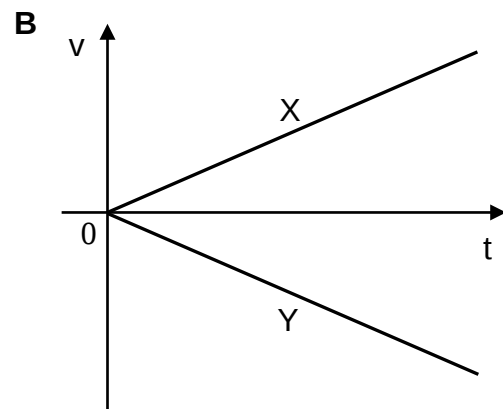
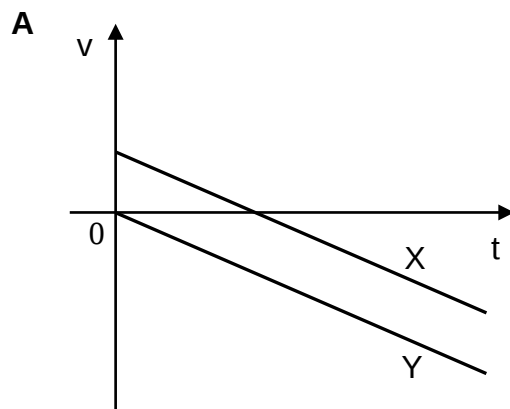
A quantity is calculated: $\frac{5.0 \text{ cm}}{0.25 \text{ s}} = 20 \text{ cm s}^{-1}$

What does this quantity represent?

- A** The average speed of the trolley passing the light gate.
- B** The instantaneous speed of the trolley passing the light gate.
- C** The average acceleration of the trolley passing the light gate.
- D** The instantaneous acceleration of the trolley passing the light gate.

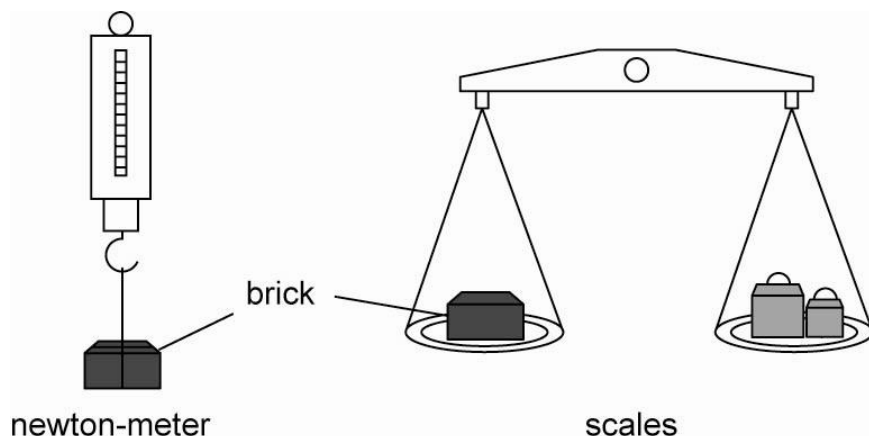
- 6** Ball X is thrown straight up in the air and, at the same instant, ball Y is released from rest and allowed to fall. Neglect air resistance.

Which velocity-time (v - t) graph best represents the motion of the two balls?



7 A brick is weighed using two instruments:

- (1) a newton-meter (or spring balance) giving readings in grams
- (2) a pair of scales (or pan balance) balancing with known masses in grams



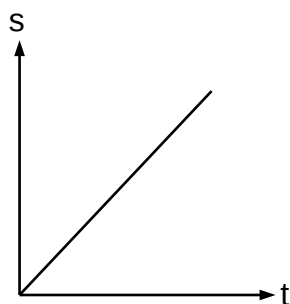
The brick is weighed again on the moon using both instruments.

Are the readings for each instrument the same or different when taken on earth and on the moon?

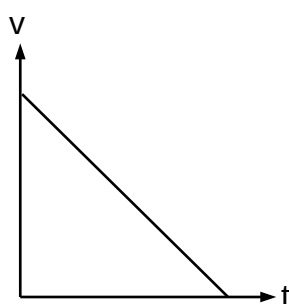
	on newton-meter	on scales
A	same	same
B	different	different
C	different	same
D	same	different

8 The following graphs describe the motion of an object.

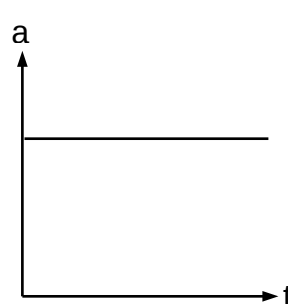
(1) displacement-time graph



(2) velocity-time graph



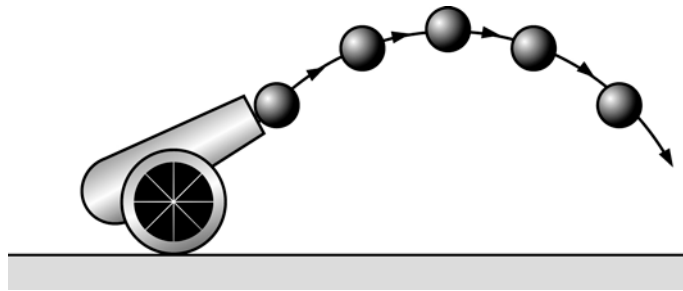
(3) acceleration-time graph



Which of the above graphs show(s) that a constant resultant force is acting on this object?

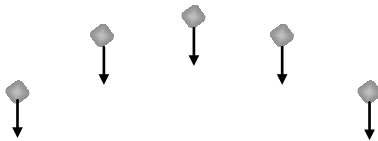
- | | | | |
|----------|------------------|----------|------------------|
| A | (1) and (2) only | B | (1) and (3) only |
| C | (2) and (3) only | D | (1), (2) and (3) |

- 9 The diagram below shows the trajectory (path) of a cannon-ball fired from a cannon.

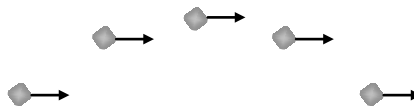


Which of the following best shows the direction of the resultant force acting on the cannon-ball at different times during its trajectory?

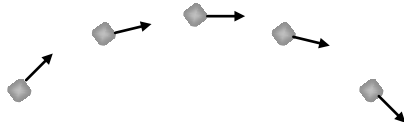
A



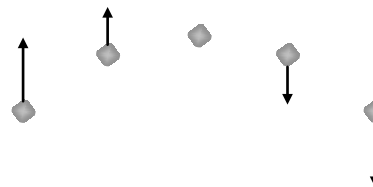
B



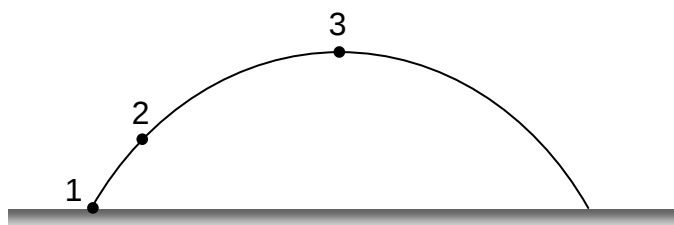
C



D



- 10 A ball is fired from a cannon at point 1 and follows the trajectory shown in the diagram below. Air resistance may be neglected.



Four possible vectors are shown below:

A zero vector

B



C $\longrightarrow$

D



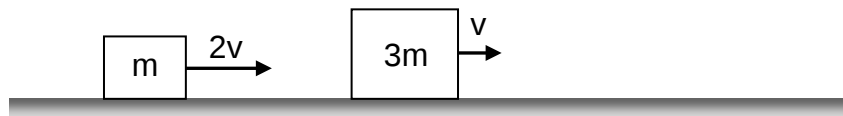
Which vector above best represents the ball's acceleration at point 2?

- 15** Curling is a sport played with 20 kg stones that slide across an ice surface. Suppose a curling stone sliding at 1.0 m s^{-1} strikes another stone and comes to rest in 2.0 ms.

Approximately how much force is exerted on the first stone during the impact?

- | | | | |
|----------|--------|----------|----------|
| A | 200 N | B | 1000 N |
| C | 2000 N | D | 10 000 N |

- 16** The diagram shows two blocks sliding on a frictionless surface. The smaller block of mass m has a speed $2v$. The bigger block of mass $3m$ has a speed v .

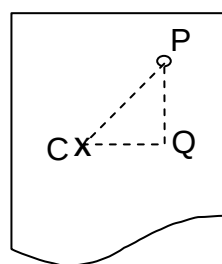


Eventually the smaller block overtakes the larger one, collides with it and sticks together.

What is the speed of the two blocks after the collision?

- | | | | |
|----------|----------------|----------|----------------|
| A | $\frac{v}{2}$ | B | $\frac{4v}{5}$ |
| C | $\frac{5v}{4}$ | D | $2v$ |

- 17** A plane lamina is freely suspended from point P. The weight of the lamina is 2.5 N and its centre of gravity is at C. The lamina is displaced to the position shown.

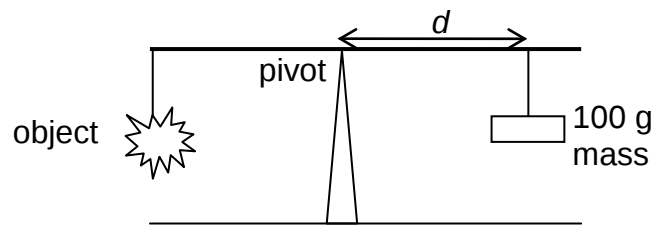


PQ = 8.0 cm
QC = 6.0 cm
CP = 10.0 cm

What is the initial moment that will cause the lamina to swing?

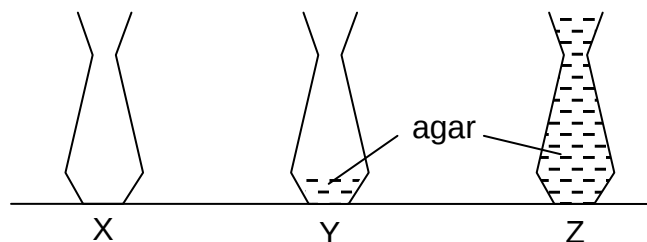
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|----------|------------------------|----------|------------------------|
| A | 15 N cm anti-clockwise | B | 20 N cm clockwise |
| C | 25 N cm clockwise | D | 25 N cm anti-clockwise |

- 18** An object hung at one end of a rod is balanced by a 100 g mass as shown below. The 100 g mass is placed at a distance d from the pivot.



If the setup is brought to Mars where the gravitational field strength is 3.7 N kg^{-1} , what should be the distance between the 100 g mass and the pivot to keep the rod balanced?

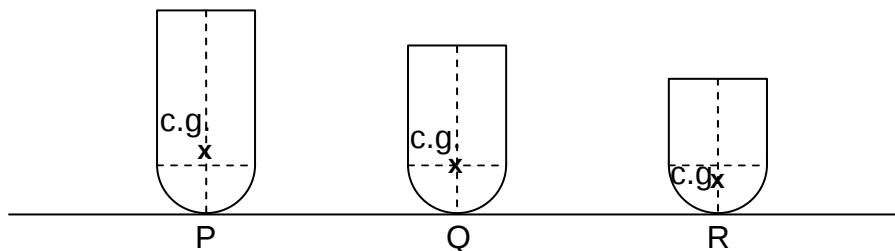
- A** d **B** $3.7 d$ **C** $3.7 d / 10$ **D** $10 d / 3.7$
- 19** The diagram below shows the cross-sections of three identical containers. Container X is empty, container Y is partially set with agar and container Z is completely set with agar.



Which of the following statements is **NOT** true about the containers?

- A** X and Z have similar maximum angles of tilt before they topple.
B The maximum angle of tilt before the container topples is largest for Y.
C The maximum angle of tilt for Z before it topples increases if the agar is replaced with a denser material.
D The maximum angle of tilt before the container topples is increased when the base area of the container is increased.

- 20** Three composite bodies P, Q and R, each consisting of a cylinder stuck on a hemisphere, rest on a horizontal plane as shown below. The hemispheres are identical. The centre of gravity (c.g.) of each body is marked.

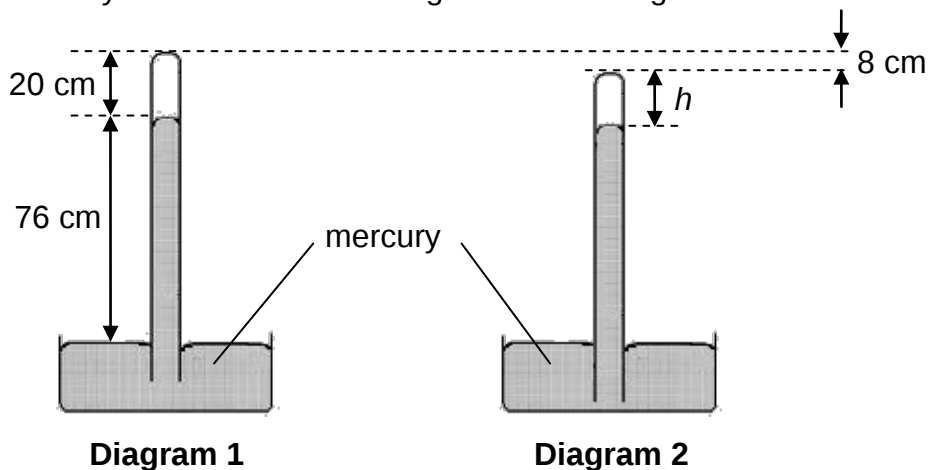


Which of the following correctly describes the states of equilibrium of P, Q and R?

	stable	unstable	neutral
A	P	Q	R
B	Q	R	P
C	Q	P	R
D	R	P	Q

- 21** The safe depth for diving in the open sea without any gear for an average person is about 40 m. However, the record for this form of diving is 100 m. Assuming that the density of seawater is $1.03 \times 10^3 \text{ kg m}^{-3}$ and the diver weighs 800 N, what is the pressure due to the sea water acting on the diver at a depth of 100 m?
- A** $8.00 \times 10^4 \text{ Pa}$ **B** $1.03 \times 10^6 \text{ Pa}$
C $8.24 \times 10^6 \text{ Pa}$ **D** $7.77 \times 10^7 \text{ Pa}$

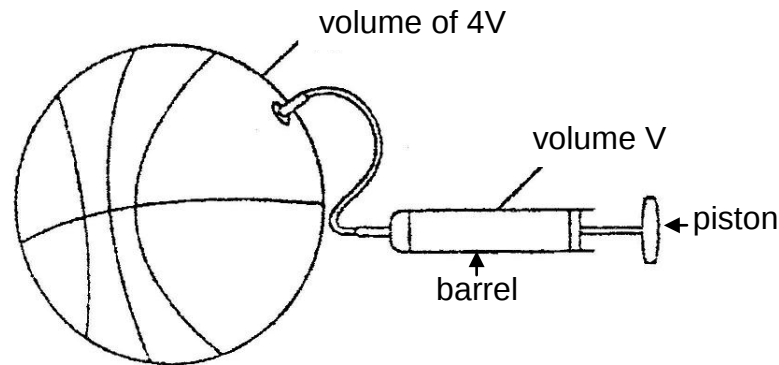
- 22** Diagram 1 below shows a simple mercury barometer. The space above the mercury column in the glass tube is a vacuum. The glass tube is then pushed vertically downwards by 8 cm as shown in diagram 2. The diagrams are not drawn to scale.



What is the height of the space above the mercury column, h ?

- A** 8 cm **B** 12 cm
C Between 12 cm and 20 cm **D** 20 cm

- 23** A ball has a volume four times that of a pump. The air inside the ball and the pump is initially at a pressure of $1.0 \times 10^5 \text{ N m}^{-2}$.



Assuming constant temperature, what is the pressure of the air after the piston of the pump has been fully pushed into the barrel?

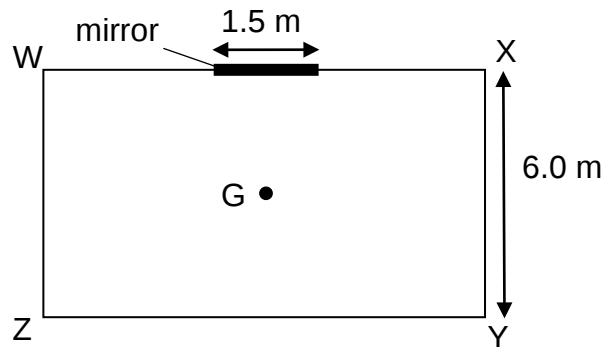
- | | | | |
|----------|------------------------------------|----------|------------------------------------|
| A | $1.0 \times 10^5 \text{ N m}^{-2}$ | B | $1.3 \times 10^5 \text{ N m}^{-2}$ |
| C | $2.5 \times 10^5 \text{ N m}^{-2}$ | D | $4.0 \times 10^5 \text{ N m}^{-2}$ |
- 24** A car of mass 1500 kg accelerates down a slope from rest and reaches the bottom of the slope at a speed of 20 m s^{-1} . The vertical height of the slope is 25 m.

What is the gain in kinetic energy of the car?

- | | | | |
|----------|-----------|----------|-----------|
| A | 300 000 J | B | 380 000 J |
| C | 600 000 J | D | 680 000 J |
- 25** Which of the following statements is true about reflection on a *plane* surface?

- A** Reflection occurs on all types of surfaces.
- B** Reflection only occurs on smooth surfaces.
- C** Images are formed whenever there is reflection.
- D** An object's image is always the same size as the object.

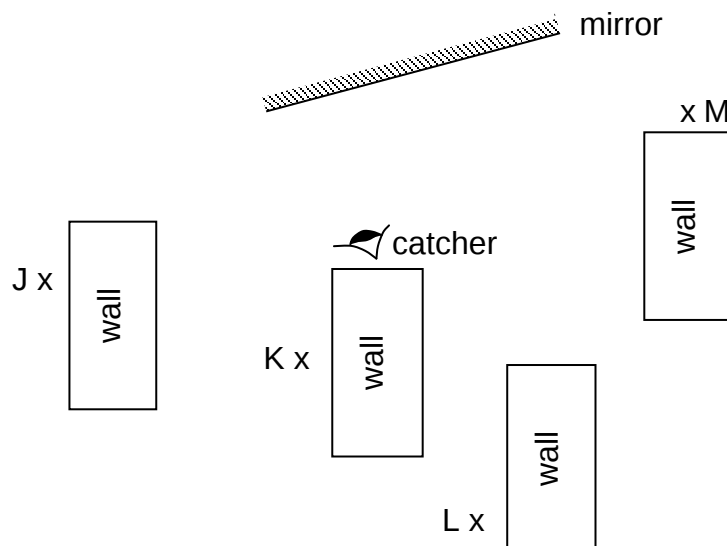
- 26** A girl stands in the centre of a rectangular room WXYZ at G facing a 1.5 m wide mirror mounted on the centre of wall WX.



What is the maximum width of the wall YZ (behind her) she can see when she looks into the mirror?

- | | | | |
|----------|-------|----------|-------|
| A | 1.5 m | B | 3.0 m |
| C | 4.5 m | D | 6.0 m |

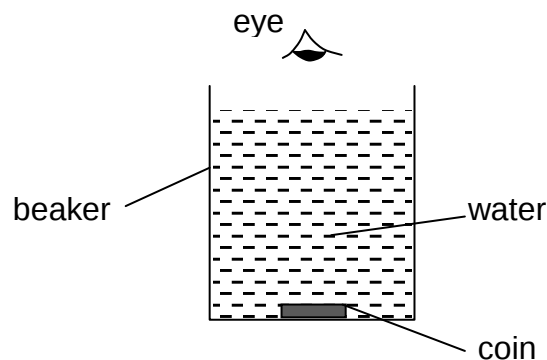
- 27** The diagram below shows the positions of the catcher and players, J, K, L and M, in a game of hide and seek. The position of each player is marked by a cross x.



Which of the following statements is true?

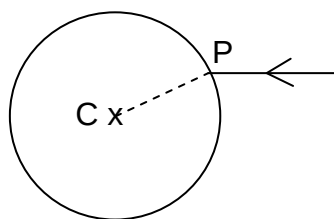
- A** The catcher can see the images of K and L in the mirror.
- B** The catcher can see the images of K and M in the mirror.
- C** The catcher can see the images of J, K and L in the mirror.
- D** The catcher can see the images of J, K and M in the mirror.

- 28** A coin is placed at the bottom of a glass beaker filled with water. A student looks into the beaker from directly above.

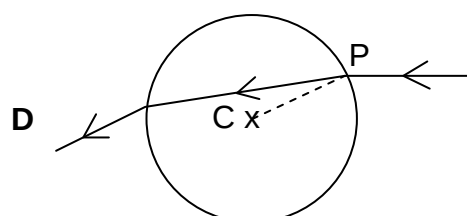
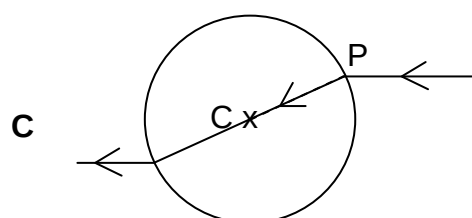
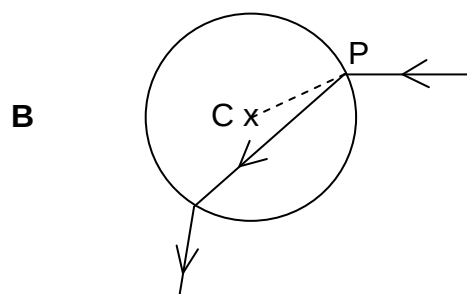
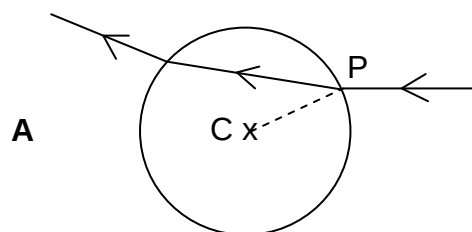


Which of the following is true of the image of the coin seen by the student?

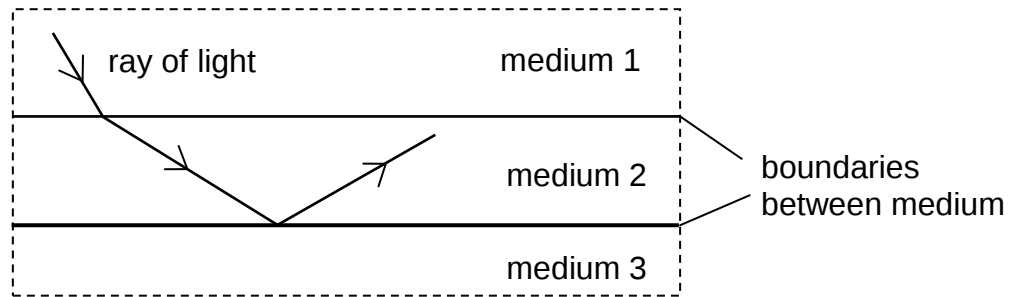
- | | |
|----------------------------|-------------------------------|
| A real, inverted | B virtual, inverted |
| C real, same way up | D virtual, same way up |
- 29** The diagram below shows a ray of light in air incident on a spherical glass ball at point P. C is the centre of the glass ball and CP is the radius of the glass ball.



Which of the diagrams below correctly shows the subsequent path of the ray of light?



- 30** The diagram below shows how a ray of light travelling from medium 1 to medium 2 is totally internally reflected.



Which of the following statements is true?

- A** Medium 2 has the largest refractive index.
- B** Medium 1 and 3 have the same refractive index.
- C** Medium 1 has a greater refractive index than medium 3.
- D** Medium 2 has a smaller refractive index than medium 3.

End of paper