2.1 Motion

Question Paper

Course	DP IB Physics
Section	2. Mechanics
Topic	2.1 Motion
Difficulty	Hard

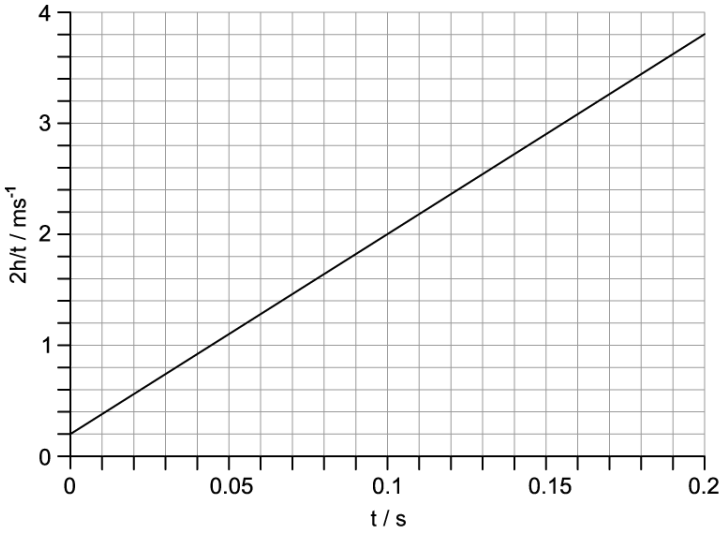
Time allowed: 20

Score: /10

Percentage: /100

Question 1

The graph shows the results obtained by a student who designed an experiment to determine the value of the acceleration due to free fall, *g*, using a falling ball bearing and a pair of light gates. The value obtained is inaccurate.



Which of the following could have contributed to the inaccurate value of *g* obtained by the student?

A. Measured values of *h* are too large due to parallax error

B. Plotting $\frac{2h}{t}$ against *t*

C. The ball bearing colliding with the light gate when travelling through

D. An increase in measured values of *t* due to residual magnetism in the release mechanism

[1 mark]

Question 2

An object is released from a stationary hot air balloon at height *s* above the ground. Air resistance is negligible.

An identical object is released at the same height above the ground from another balloon that is rising at a constant speed.

Which of the following does not increase for the object released from the rising balloon?

A. The time taken for it to reach the ground

B. The distance through which it falls

C. Its acceleration

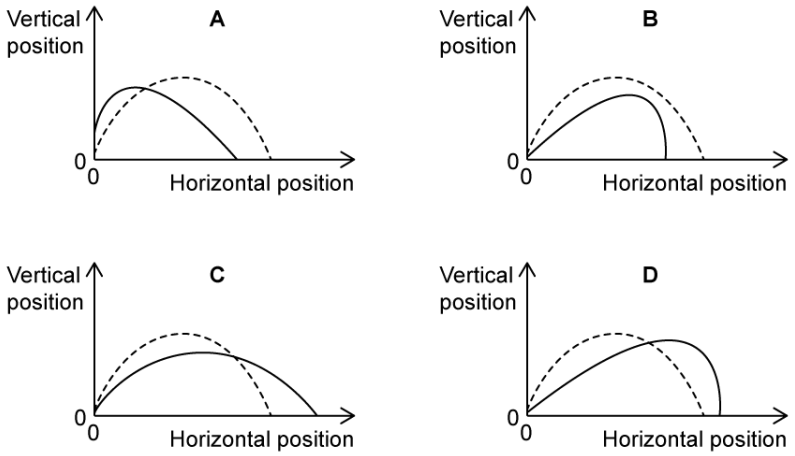
D. The speed with which it hits the ground

[1 mark]

Question 3

An object is projected in a vacuum chamber and in a playing field (where air resistance is taken into account). Otherwise, all initial conditions are equivalent.

Which graph shows correct trajectory for the object in the vacuum chamber and in the playing field?



[1 mark]

Question 4

A projectile is fired from level ground with speed v at an angle θ to the ground. Ignoring air resistance, which of the following is a correct expression for the maximum height reached by the projectile?

A. $\frac{v^2 \sin^2 \theta}{g}$

B. $\frac{v \sin^2 \theta}{2g}$

C. $\frac{v^2 \sin^2 \theta}{2g}$

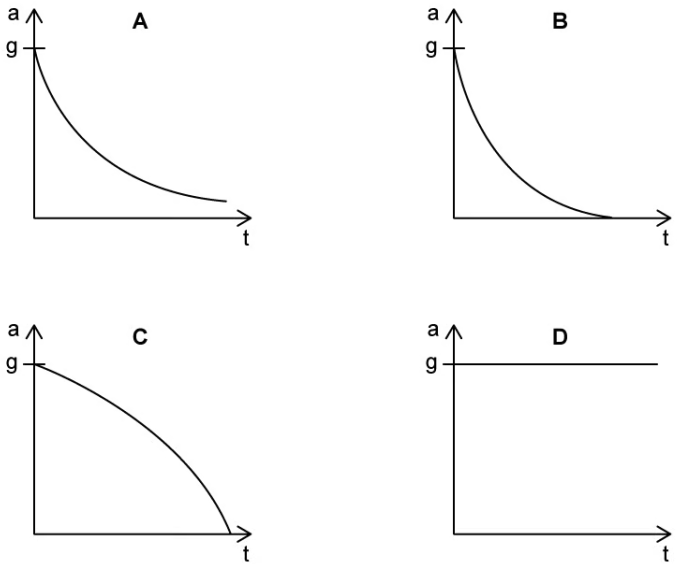
D. $\frac{v \sin^2 \theta}{g}$

[1 mark]

Question 5

An object is dropped from height and falls through air of uniform density.

Which of the following is the correct acceleration-time graph for the object?

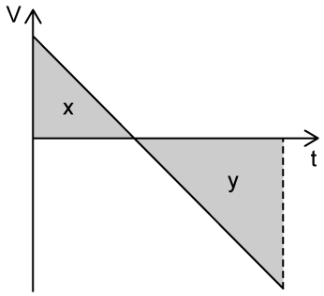


[1 mark]

Question 6

An object is thrown vertically upwards from the top of a cliff. It then falls directly below into the sea.

The graph shows the vertical component of velocity *v* varies with time *t*.



How high is the cliff-top from the surface of the sea?

A. X

B. Y

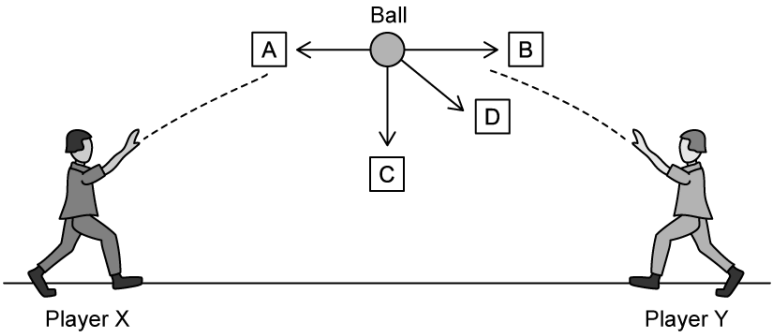
C. Y + X

D. Y – X

[1 mark]

Question 7

Baseball player Y throws a ball to baseball player X as shown.



What is the direction of the net force on the ball at the instant shown, if air resistance is not neglected?

[1 mark]

Question 8

On a clear day, in the absence of air resistance, a cannon ball is fired at an angle θ to the ground with an initial velocity u. Its horizontal range is s. Which of the following statements is incorrect?

A. The time of flight is $\frac{s}{u \cos \theta}$

B. The time of flight is $\frac{2u \sin \theta}{g}$ where g is the acceleration of free fall

C. The shadow of the cannon ball moves with a constant velocity while the ball is in flight

D. The linear momentum of the cannon ball is constant during flight

[1 mark]

Question 9

A body of mass *m* is projected at an angle φ to the horizontal in a gravitational field. Its trajectory is parabolic and follows the path PQRST. These points are the position of the body along its trajectory at equal time intervals, with T being the object's maximum height.

The displacements PQ, QR, RS and ST are:

A. equal

B. decrease at a constant rate

C. increase at a constant rate

D. have equal horizontal components

[1 mark]

Question 10

A small uniform bob is attached to a simple pendulum, and set into motion from some angular displacement. When the bob passes through the lowest point of its motion, the pendulum is cut. If, at this instant, the bob is moving with a speed of *v* m s^{-1}, at a height *h* above ground, how far away does the bob land from a position measured directly under the point at which the pendulum is cut?

A. $\sqrt{\frac{h}{g}}$

B. $v\sqrt{\frac{h}{g}}$

C. $v\sqrt{\frac{2h}{g}}$

D. $v\sqrt{\frac{h}{2g}}$

[1 mark]