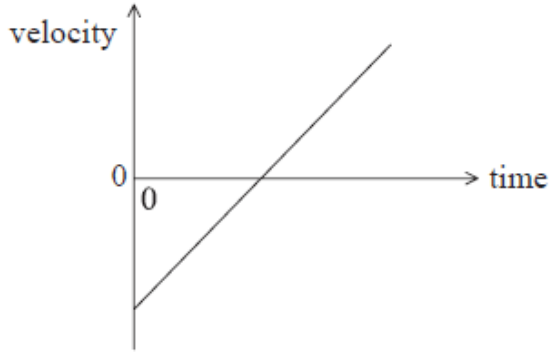
IB Physics SL Y2 – Paper 1 and Paper 2 Review – Topic 2 Assignment (33 Marks)

Name: _____ Date: _____ Period: _____

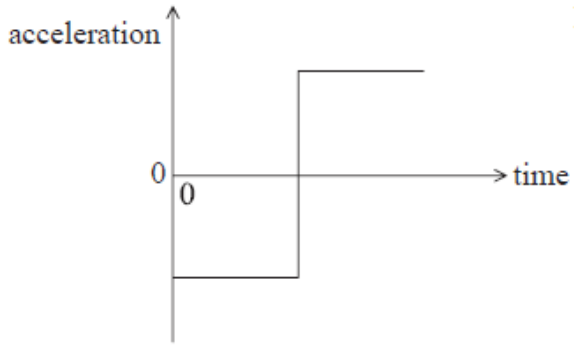
Objectives:
2.1 Kinematics
2.2 Forces and dynamics
2.3 Work, energy, and power
2.4 Uniform circular motion

1. **Two balls of different mass are dropped from the top of a tall building one after the other. The distance between the balls**
   A. increases with time.
   B. depends on the initial velocity only.
   C. remains constant.
   D. depends on the mass of the balls.

2. **The graph shows how the velocity of a particle varies with time.**



Which of the following graphs correctly shows how the acceleration of the particle varies with time?

A.


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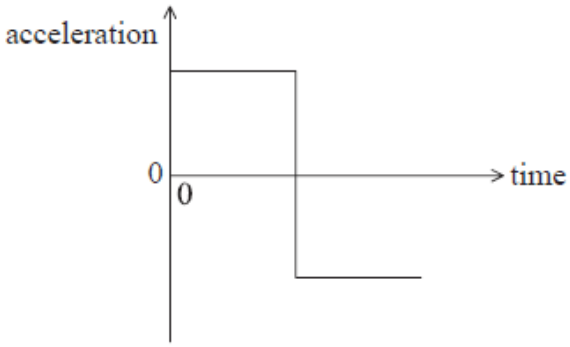

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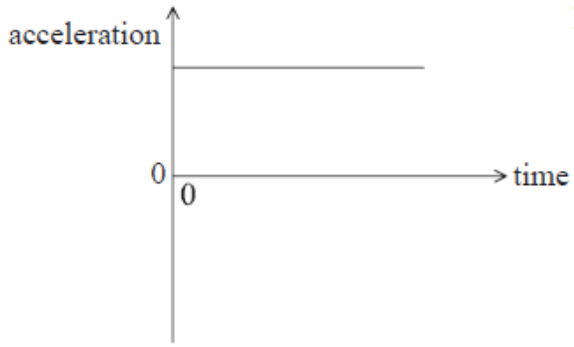
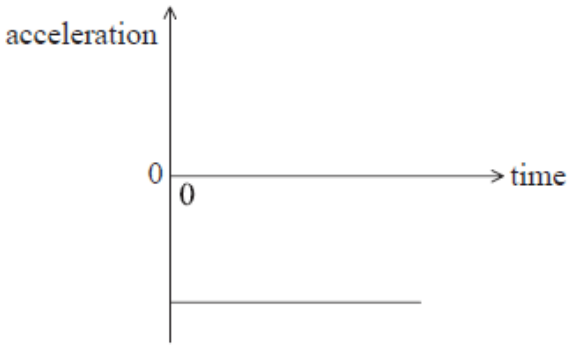


D.


3. An aircraft is flying at constant speed in a horizontal circle. Which of the following diagrams best illustrates the forces acting on the aircraft in the vertical plane?

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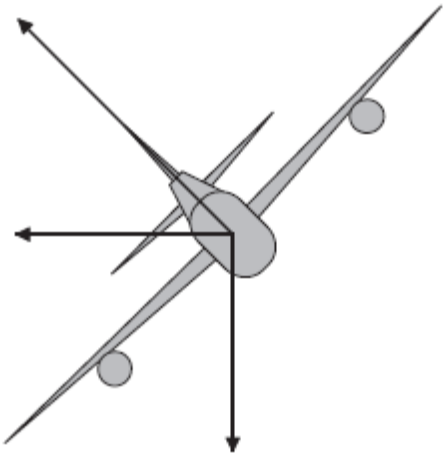
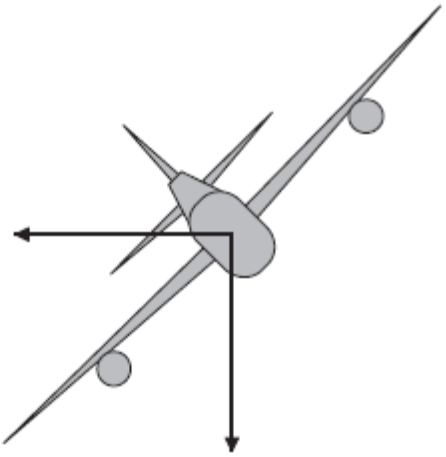
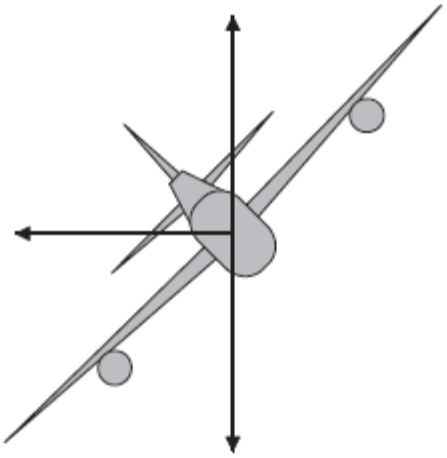


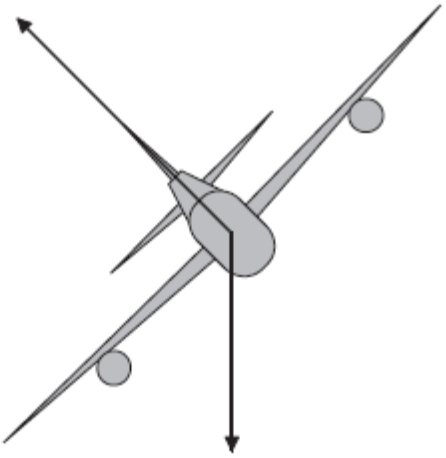
B.



C.



D.



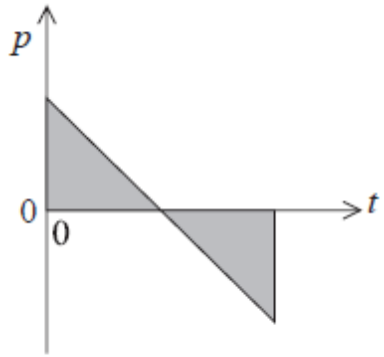
4. For a particle moving at constant speed in a horizontal circle, the work done by the centripetal force is

A. zero.
B. directly proportional to the particle mass.
C. directly proportional to the particle speed.
D. directly proportional to the (particle speed)^2.

5. A vehicle is driven up a hill at constant speed. Which of the following best describes the energy changes involved?

A. Chemical energy is converted into gravitational potential energy.
B. Chemical energy is converted into gravitational potential energy, sound and thermal energy.
C. Gravitational potential energy is converted into chemical energy.
D. Gravitational potential energy is converted into chemical energy, sound and thermal energy.

6. A rubber ball, travelling in a horizontal direction, strikes a vertical wall. It rebounds at right angles to the wall. The graph below illustrates the variation of the ball's momentum p with time t when the ball is in contact with the wall.



Which of the following statements is true?

A. The shaded area is equal to the force exerted by the wall on the ball.
B. The shaded area is equal to the force exerted by the ball on the wall.
C. The gradient is equal to the force exerted by the wall on the ball.
D. The gradient is equal to the force exerted by the ball on the wall.

This question is about impulse.

(a) A net force of magnitude F acts on a body. Define the *impulse* I of the force. *[1]*

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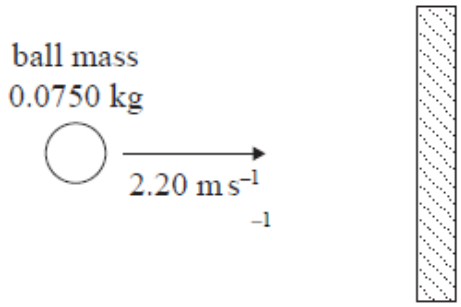
(b) A ball of mass 0.0750 kg is travelling horizontally with a speed of 2.20 $m\,s^{-1}$. It strikes a vertical wall and rebounds horizontally.



Due to the collision with the wall, 20 % of the ball's initial kinetic energy is dissipated.

(i) Show that the ball rebounds from the wall with a speed of 1.97 $m\,s^{-1}$. *[2]*

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(ii) Show that the impulse given to the ball by the wall is 0.313 N s. *[2]*

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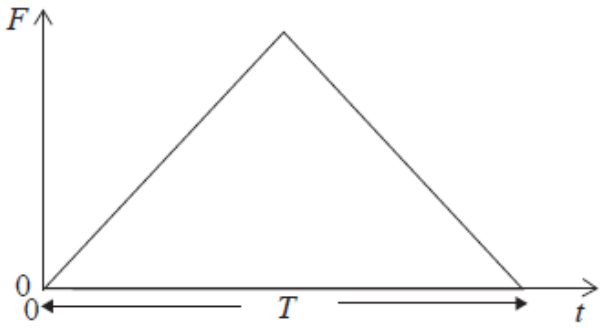
(c) The ball strikes the wall at time $t = 0$ and leaves the wall at time $t = T$.

The sketch graph shows how the force F that the wall exerts on the ball is assumed to vary with time t.



The time T is measured electronically to equal 0.0894 s.

Use the impulse given in (b)(ii) to estimate the average value of F. *[4]*

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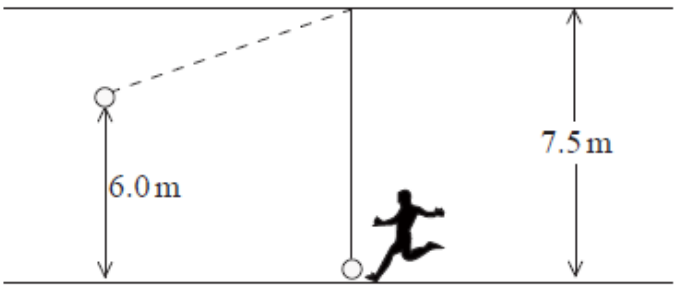
Part 2 Kicking a football

A ball is suspended from a ceiling by a string of length 7.5 m. The ball is kicked horizontally and rises to a maximum height of 6.0 m.



(a) Assuming that the air resistance is negligible, show that the initial speed of the ball is $11\,m\,s^{-1}$. *[2]*

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(b) The mass of the ball is 0.55 kg and the impact time of the kicker's foot with the ball is 150 ms. Estimate the average force exerted on the ball by the kick. *[2]*

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(c) (i) Explain why the tension in the string increases immediately after the ball is kicked. *[3]*

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(ii) Calculate the tension in the string immediately after the ball is kicked. Assume that the string is vertical. *[3]*

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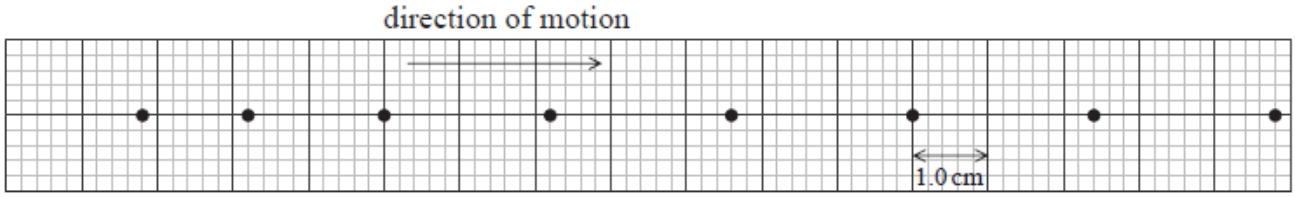
Part 2 Linear motion

A car moves along a straight road. At time $t=0$ the car starts to move from rest and oil begins to drip from the engine of the car. One drop of oil is produced every 0.80 s. Oil drops are left on the road. The position of the oil drops are drawn to scale on the grid below such that 1.0 cm represents 4.0 m. The grid starts at time $t=0$.



(a) (i) State the feature of the diagram above which indicates that, initially, the car is accelerating. *[1]*

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(ii) On the grid above, draw further dots to show where oil would have dripped if the drops had been produced from the time when the car had started to move. *[2]*

(iii) Determine the distance moved by the car during the first 5.6 s of its motion. *[1]*

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(b) Using information from the grid above, determine for the car,

(i) the final constant speed. *[2]*

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(ii) the initial acceleration. *[2]*

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