Physics SL

IB1 Examination

- Paper 2 -

7 Questions

Friday 13 Dec. 2024

Maximal time : 1h45

Name :

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/ 56 marks

Question 1   [/6 marks]

A glider is an aircraft with no engine. To be launched, a glider is uniformly accelerated from rest by a cable pulled by a motor that exerts a horizontal force on the glider throughout the launch.

Un planeador es un avión sin motor. Para ser lanzado, un planeador se acelera uniformemente desde el reposo.

por un cable tirado por un motor que ejerce una fuerza horizontal sobre el planeador durante todo el despegue.

グライダーはエンジンを持たない航空機である。グライダーを発進させるには、静止状態からモーターに引っ張られたケーブルによって一様に加速される。

モーターで引っ張られたケーブルによって加速される。
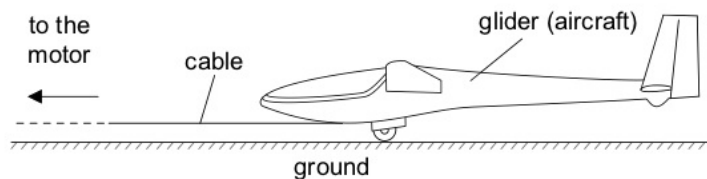
1) The glider reaches its launch speed of 27.0 m s after accelerating for 11.0s.

Assume that the glider moves horizontally until it leaves the ground.

Calculate the total distance travelled by the glider before it leaves the ground.

El planeador alcanza su velocidad de despegue de 27,0 m s tras acelerar durante 11,0s.

Supongamos que el planeador se mueve horizontalmente hasta que abandona el suelo.

Calcula la distancia total recorrida por el planeador antes de abandonar el suelo.

2)   The glider and pilot have a total mass of 492 kg.

During the acceleration the glider is subject to an average resistive force of 160 N.

Determine the average tension in the cable as the glider accelerates.

El planeador y el piloto tienen una masa total de 492 kg.

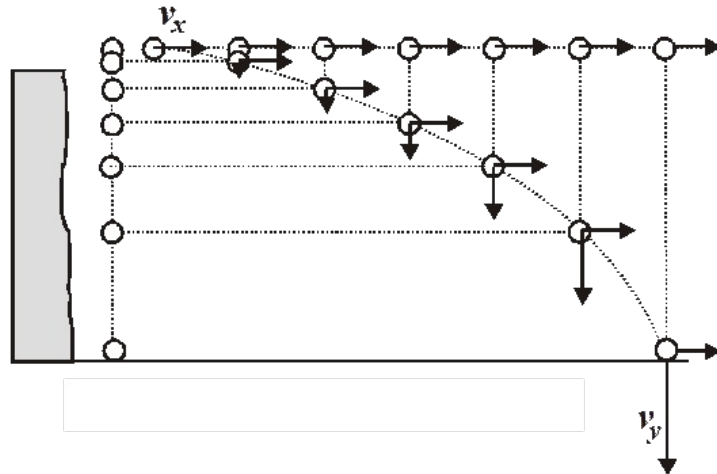Durante la aceleración el planeador está está sometido a una fuerza resistiva media de 160 N.

Determinar la tensión media del cable al acelerar el planeador.

グライダーとパイロットの総質量は492kg。加速中、グライダーは 平均160 Nの抵抗力を受ける。
ケーブルの平均張力を求めよ。

Question 2   *[/9 marks]*

An archer send an arrow horizontally   (アーチェリー。矢印は水平に投影されます。)

Horizontally : The initial value of V_x is 12m/s.

Vertically : The initial value of V_y is 0 m/s,

The acceleration is $a = g = 9.81\,m\,s^{-2}$, you can take $a = g = 10\,m\,s^{-2}$.

1) Explain why the *horizontal* component of the velocity is *constant*.

速度の水平成分が一定である理由を説明してください

Explique por qué la componente horizontal de la velocidad es *constante*.

2) What about the *vertical* component of the velocity ?

3) How long time it will take for the arrow to reach the ground ?

4) What is the *horizontal distance* that the arrow travels before reaching the ground ?

¿Cuál es la distancia horizontal que recorre la flecha antes de llegar al suelo?
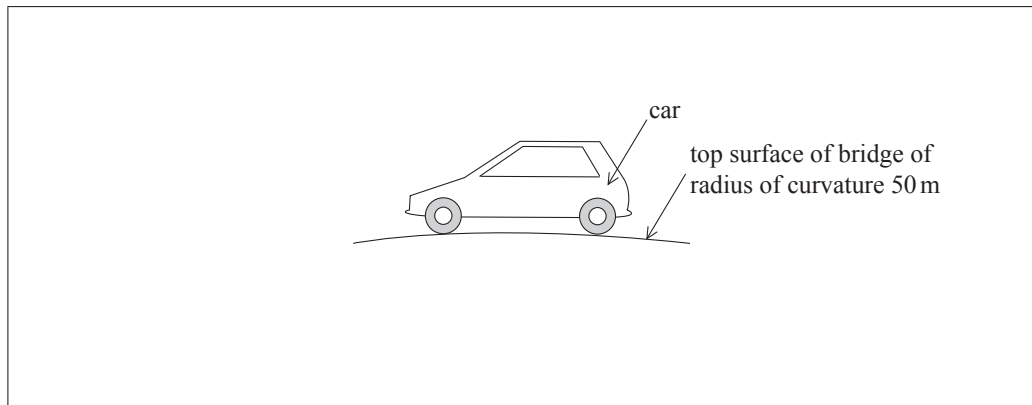
矢が地面に到達するまでに進む水平距離はどれくらいですか?

Question 3   [/7 marks]

This question is about circular motion.

The diagram shows a car moving at a constant speed over a curved bridge. At the position shown, the top surface of the bridge has a radius of curvature of 50 m.

car

top surface of bridge of
radius of curvature 50 m

(a) Explain why the car is accelerating even though it is moving with a constant speed.   [2]

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(b) On the diagram, draw and label the vertical forces acting on the car in the position shown.   [2]

(c) Calculate the maximum speed at which the car will stay in contact with the bridge.   [3]

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Question 4   *[/6 marks]*

Four persons are pushing a car of mass 1400 kg.

質量1400kgの車を4人で押す   Cuatro personas empujan un coche con una masa de 1400 kg.

The two parents have forces 120 N and 90 N

2 つの親の力は 120 N と 90 N です。 Los dos padres tienen fuerzas de 120 N y 90 N.
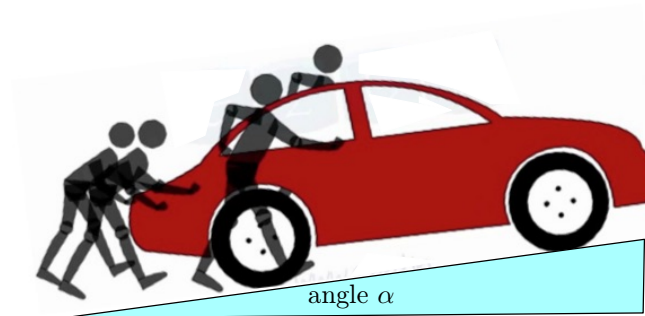
The two children have forces 67 N and 43 N

There is a *friction force* (fuerza de fricción　摩擦力) of 40 N

1) What is the *acceleration* of the car ?

2) Now the same people push the same car (with the same forces)

   but the road has an inclination of angle $\alpha = 1^0$.

angle α

 3) Explain why, in that situation, it will be fore difficult to push the car.

   そのような状況で、なぜ車を押すことがより困難になるのか説明しなさい。

4

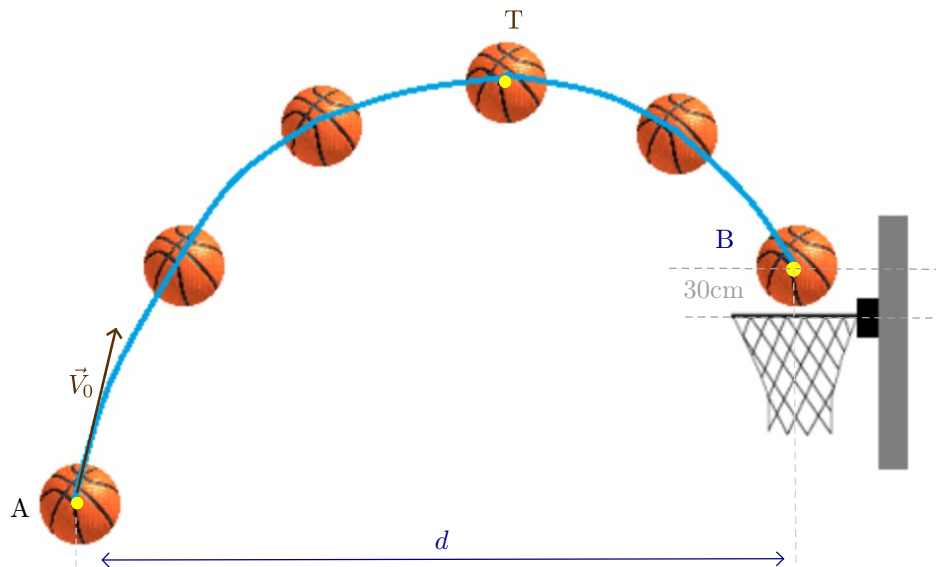**Question 5** [/13 marks]

A basket ball is sent with the initially velocity $\vec{V_0} = \left(\begin{smallmatrix} 3 \\ 12 \end{smallmatrix} \right)$,

that means : 3m/s *horizontally* and 12 m/s *vertically*, as show in the picture.

The initial position A of the ball (projected by a player) is $x = 0$, at 1.7m height.

1) What is the *name* of the trajectory of the ball ?

2) Find how long time it will take to the ball to reach the top position T.

3) Find the coordinates (that is x and the hight y, in m) of position T.

4) Position B is 30 cm above the basket net bar.

The horizontal displacement of the ball from A to B is $d = 6.7m$

Find the hight of the basket net bar.
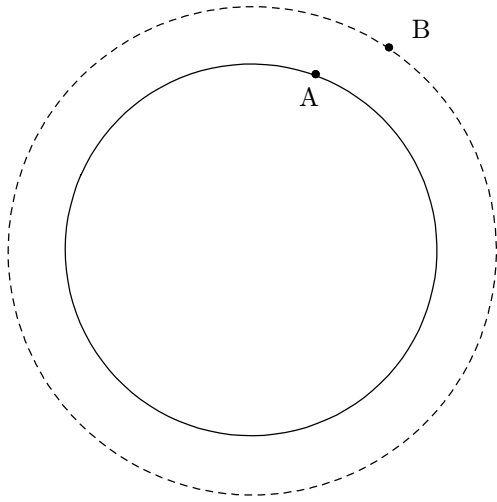
Question 6 [/5 marks]

A hare and a tortoise are having a race along a 60 m track.
At time $t = 0$, the tortoise starts running at 1m/s.
The hare sleeps a long time.

Finally at time t=50s he starts running,
with a constant acceleration $a = 1m/s$.
Who will win the race ?

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Question 7

Let two bodies A and B are moving on two horizontal circles or radius $R_1 = 2m$ and $R_2 = 2.5m$ with constant speeds.

1) If the frequency of rotation of A is 8Hz, and if both A and B have the *same angular speed* $(\omega_1 = \omega_2)$ then:

  a) What is the *speed* of each one ?

  b) What is the *period* of each one ?

2) If now A and B have *same speed*: $v_1 = v_1 = 10 m s^{-1}$ then

    a) what is the *angular speed* of each one ?

    b) How many *turns* B complete in 50.27sec ?

    c) How long time it would take for A for completing this number of turns ?