Formative Student Answers Instructions

created 2019/12/08, updated 2020/03/17

For each topic we have a set of questions as a formative assessment. You can find all the <u>Word documents</u> (pdf) in the shared folder "IB Physics students > Formative" or in ManageBac. Check which questions you are assigned to: <u>Class of 2020</u>, <u>Class of 2021</u>. Use the <u>formula booklet</u>.

Post your answer into the respective folder and name the file as [topic]-[question].[ipynb]. For example, if you answer the 5th question on 4.3 Wave characteristics your file name would be 4.3-05.ipynb. The answer consists of a text block and a code block. Document your work. If you are not comfortable with Jupyter notebook you can use a regular word document or Google Doc.

1) Start with the question

Copy the question and related pictures into your document. Convert numbers in the text part into math mode (place inside dollars a=5) to use _{subscript}, ^{superscript} and \alpha \leq $a\le$.

2) Answer your question

Include given values, formula, solution and answer. Refer to the formula booklet, if possible.

3) Calculation

Add a code block where you define all variables, add the formula and compute the result. Document your work with # lines. Add a space between # and your comment.

Examples



<u>Playlist with tutorial and solution videos</u>

As of 2020/03/25: 9 videos, 122 minutes.

Answers to Topic 2 Mechanics are found in <u>this folder</u>.

Answers to Topic 6 Circular motion and gravitation are found in <u>this folder</u>.

Answers to Topic 9 Wave phenomena are found in <u>this folder</u>.

Answers to Topic 12 Quantum and nuclear physics are found in <u>this folder</u>.

A 25-N crate is given an initial velocity of 8.0 ms⁻¹ on a floor. It slides 12 m.

11. Find the constant acceleration of the crate.

Given: $u = 8.0 \text{ ms}^{-1}$ explicit

s = 12 m explicit

 $v = 0 \text{ ms}^{-1}$ implicit (stops after 12m)

Formula: $v^2 = u^2 + 2as$ timeless from 2.1 Motion

Solution: 0 = 64 + 2a12

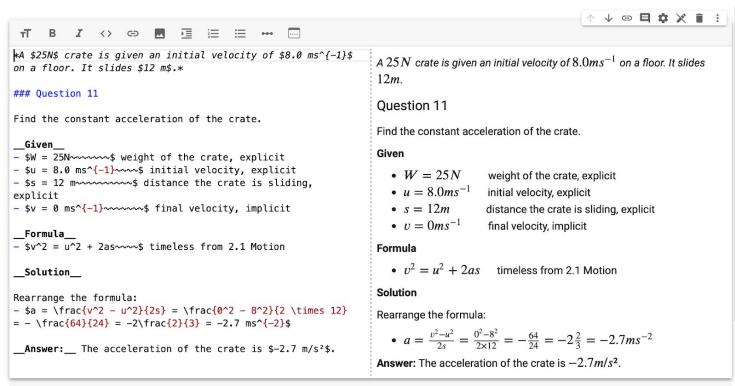
a = (-64)/24

a = -8/3

 $a = -2.7 \text{ ms}^{-2}$ 2 significant figures, based on the given values

Answer 11: The constant acceleration of the crate is -2.7 ms⁻².

Jupyter notebook answer:



[] u = 8 # initial velocity in m/s
s = 12 # dinstance the crate is sliding, in meter
v = 0 # final velocity in m/s
a = (v**2 - u**2) / (2 * s)
print("The acceleration of the crate is {:.1f} m/s²".format(a))

 \rightarrow The acceleration of the crate is -2.7 m/s²

12. Find the friction force that stops the crate.

Given: W = 25 N explicit (weight of the crate)

g = - 9.81 ms⁻² implicit (gravitational acceleration for the weight)

a = -2.667 ms⁻¹ implicit (result from question 11)

Formula: W = mg weight

F = ma Newton's second law

Solution: m = W/g = 25/9.81 = 2.55

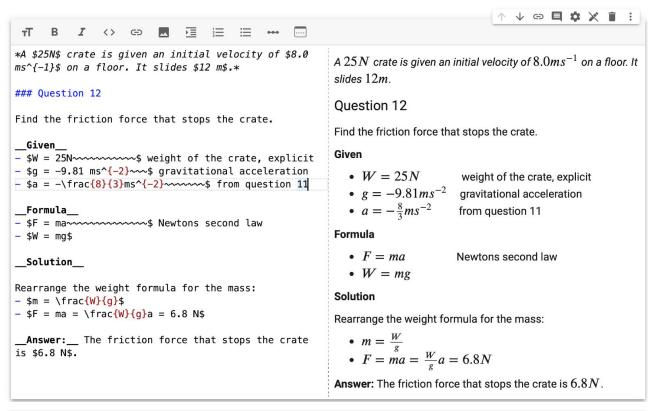
m = 2.55 kg

 $F = ma = W/g \times a = 25/(-9.81) \times (-2.67) = 6.80$

F = 6.8 N

Answer 12: The force that stops the crate is 6.8 Newton.

Solution in Jupyter notebook:



```
[5] W = 25  # weight of the crate in Newton
    g = -9.81  # gravitational acceleration in m/s²
    a = -8 / 3  # acceleration of the crate, from question 11

F = W / g * a

print("The friction force that stops the crate is {:.3f} N".format(F))
```

 $\underset{\longrightarrow}{}$ The friction force that stops the crate is 6.796 N

These are examples from December 2019, here only for reference. Use the updated ones above.

Old documents 2.2-11.jpynb or 2.2-11.doc and 2.2-12.jpynb or 2.2-12.doc

A 25-N crate is given an initial velocity of 8.0 ms⁻¹ on a floor. It slides 12 m.

11. Find the constant acceleration of the crate.

Given: $u = 8 \text{ ms}^{-1}$ explicit

s = 12 m explicit

v = 0 ms⁻¹ implicit (stops after 12m)

Want: a acceleration

Formula: $v^2 = u^2 + 2as$ timeless

Solution: 0 = 64 + 2a12

a = (-64)/24

a = -8/3

 $a = -2.7 \text{ ms}^{-2}$

Answer 11: The constant acceleration of the crate is -2.7 ms⁻².

In Jupyter notebook:

A 25-N crate is given an initial velocity of 8.0 ms-1 on a floor. It slides 12 m.

11. Find the constant acceleration of the crate.

Given:

- $u = 8ms^{-1}$ explicit
- s = 12m explicit
- $v = 0 m s^{-1}$ implicit (stops after 12m)

Want:

• a acceleration

Formula:

• $v^2 = u^2 + 2as$ timeless

Transformed for a:

$$a = \frac{v^2 - u^2}{2s}$$

Solution:

•
$$0 = 64 + 2a12$$

 $a = (-64)/24$

$$a = -\frac{8}{3}$$

$$a = -2.7 ms^{-2}$$

Answer 11: The constant acceleration of the crate is $-2.7ms^{-2}$.





12. Find the friction force that stops the crate.

Given: $u = 8 \text{ ms}^{-1}$ explicit

s = 12 m explicit $v = 0 ms^{-1}$ implicit (stops after 12m)

g = 9.81 ms⁻² implicit (gravitational acceleration for the weight)

W = 25 N explicit (weight of the crate)

a = -2.7 ms⁻¹ implicit (result from question 11)

Want: m mass of the crate

F force

Formula: W = mg weight

F = ma Newton's second law

Solution: m = W/g = 25/9.81 = 2.55

m = 2.55 kg

 $F = ma = 2.55 \times (-2.67) = 6.80$

F = 6.8 N

Answer 12: The force that stops the crate is -6.8 Newton.

· 12. Find the friction force that stops the crate.

Given:

- $g=9.81ms^{-2}$ implicit (gravitational acceleration for the weight)
- W=25N explicit (weight of the crate)
- $a = -2.7ms^{-1}$ implicit (result from question 11)

Want:

- m mass of the crate
- ullet F force that stops the crate

Formula:

- ullet W=mg weight
- ullet F=ma Newton's second law

Solution:

• m = W/g = 25/9.81 = 2.55

m = 2.55kg

 $F = ma = 2.55 \times (-2.67) = 6.80$

F = 6.8N

Answer 12: The force that stops the crate is -6.8N.

```
g = 9.81  # gravitational acceleration (formula booklet)
W = 25  # weight of the crate in Newton
a = -2.6666667  # acceleration of the crate

m = W / g
print('Mass of the crate:',m,'kg')
F = m * a
print('Force to stop the crate:',F,'N')

Mass of the crate: 2.54841997961264 kg
Force to stop the crate: -6.7957866972477055 N
```