If we take the mass m to zero while fixing the momentum p constant, the ratio E/p becames

A) 0

B) infinity

C) 1

D) c

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$E/p = c^2 / v = c$ if v approaches c

Can a massless particle be at rest?

Hint: consider a Lorentz transformation of its energy and momentum.

A) yes, the particle is at rest in its own rest frame

B) no

Can a massless particle be at rest?

Hint: consider a Lorentz transformation of its energy and momentum.

A) yes, the particle is at rest in its own rest frame

B) no

A massless particle has no rest frame and is always moving with the speed of light

If a massless particle had a rest frame, it would have E=0 and p=0 in that frame. But then it would have E=0 and p=0 in ALL frames!
an impossibility.

A steel beam is heated up from 300K to 1000K.
The rest mass of the steel beam...

A) increases

B) stays the same

C) decreases

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The rest mass of the steel beam...

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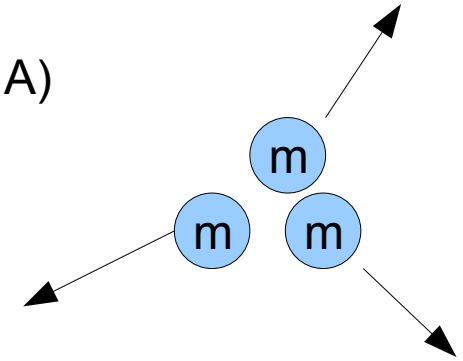
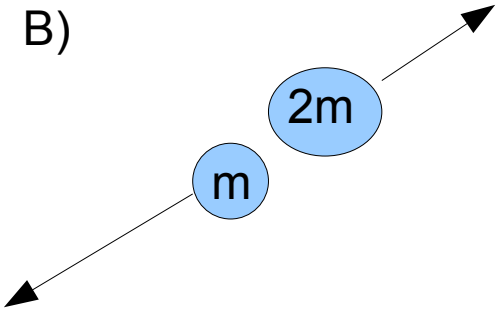
Energy is added. Since that energy is internal ('invisible'), it must increase the mass of the object.

A stationary nucleus of mass 3m decays into smaller nuclei. Which of the following is a possible final state of this decay?

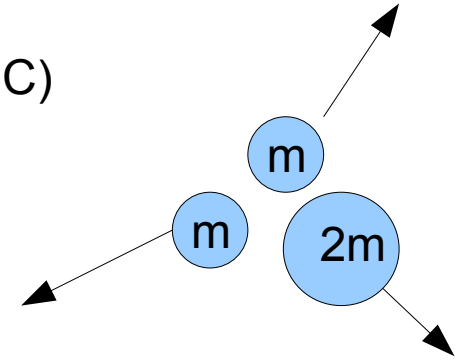
A)



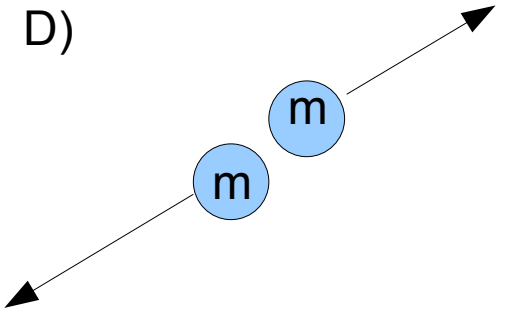
B)



C)



D)



E) both A and B

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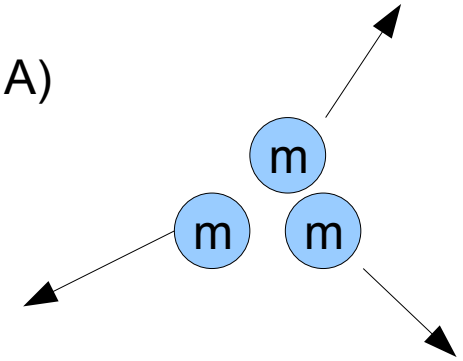
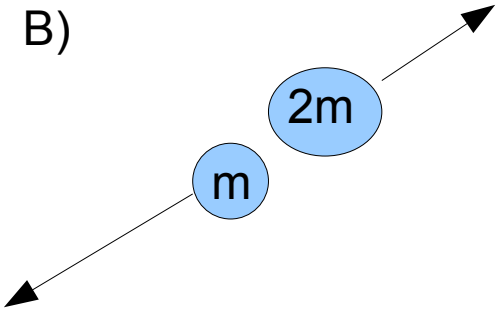
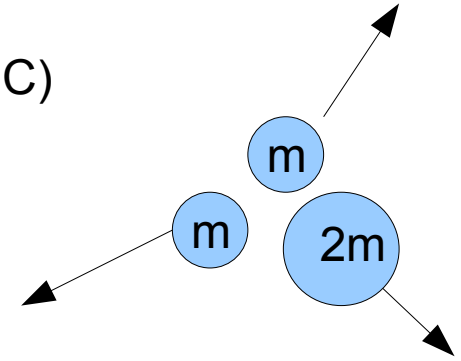


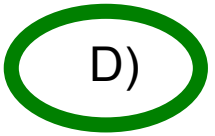
B)

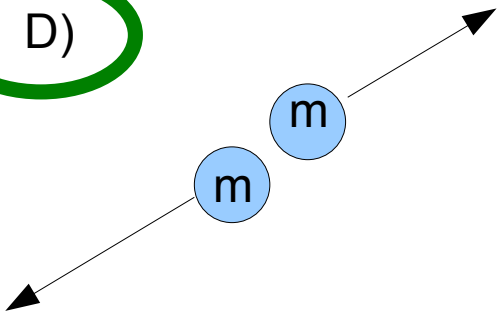


C)



D)





D, since in all the other cases the rest mass energy plus the kinetic energy is greater than the original energy available, $3mc^2$

E) both A and B

How does the rest mass of a hydrogen atom compare to the mass of a proton and an electron?

A) it is equal: $m_H = m_e + m_p$

B) it is greater than: $m_H > m_e + m_p$

C) it is less than: $m_H < m_e + m_p$

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The energy stored in hydrogen is negative (you have to add energy to break hydrogen apart into protons and electrons).
This is a bound state: it's mass is lower than the sum of the masses of the constituents

A stationary particle of mass M decays into two particles. According to an observer moving with speed v with r respect to the original particle, the total energy of the decay products is

A) equal to Mc^2

B) less than Mc^2

C) more than Mc^2

D) can't tell, not enough information

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In the moving frame, the original particle had energy greater than Mc^2, since it was moving. Therefore the products have energy greater than Mc^2 as well.