E=mc² is wrong? - Sixty Symbols

http://www.youtube.com/watch?v=mkiCPMjpysc

1) Who and when formulated this famous equation?
2) What do the letters E, m, and c in this equation indicate?

Listen to and watch the video and decide whether the statements are true or false.

1) Mass of particles can be measured in joules.
2) Considering the Newton's Laws of Motion, energy is the same as mass.
3) Large amount of energy is equivalent to huge amount of mass.
4) Mass is always a source of energy.
5) p^2 c^2 indicates movement.
6) In the original equation, mass is moving.
7) M_0 means that there is no momentum of a particle.
8) Speed of sound is not used because it is a much higher number.
9) People do not realize how important this equation is.
10) The public is not able to understand **E=mc²** because it is too complicated.

Reading The greatest equations ever

Critical Point: October 2004. Written by Robert P. Crease

Pre-reading

These are some equations mentioned in the text. Try to specify what these equations indicate.

1) $E = mc^2$ 2) $F = ma$ 3) $1 + 1 = 2$ 4) $v = H_0d$
5) □S = 0 6) $e^{i\pi} + 1 = 0$ 7) $a/b = c/d$ 8) $a^2 + b^2 = c^2$
9) $V = IR$ 10) $PV = nRT$

Read the text and check your answers.

Maxwell's equations of electromagnetism and the Euler equation top a poll to find the greatest equations of all time. Robert P. Crease discusses the result of his reader survey.

Earlier this year I asked readers to send me their shortlist of great equations. I also asked them to explain why their nominations belonged to the list and why, if at all, the topic matters.
I received about 120 responses – including single candidates as well as lists – proposing about 50 different equations. They ranged from obvious classics to "overlooked candidates", personal favourites and equations invented by the respondents themselves.
Several people inquired about the difference between formulae, theorems and equations – and which I meant. Generally, I think of a formula as something that obeys the rules of a syntax. In this sense, $E = mc^2$ is a formula, but so is $E = mc^3$. A theorem, in contrast, is a conclusion

derived from more basic principles – Pythagoras's theorem being a good example. An equation proper is generally a formula that states observed facts and is thus empirically true. The equation that describes the Balmer series of lines in the visible spectrum is a good example, as are chemical equations that embody observations about reactions in a laboratory. However, these distinctions are not really so neat. Many classic Physics equations – including $E = mc^2$ and Schrödinger's equation – were not conclusions drawn from statements about observations. Rather, they were conclusions based on reasoning from other equations and information; they are therefore more like theorems. And theorems can be equation-like for their strong empirical content and value.

Simplicity

Respondents had many different criteria for greatness in equations. Half a dozen people were so impressed with simplicity that they proposed 1 + 1 = 2. "I know that other equations have done more, express greater power and have a broader understanding of the universe," wrote Richard Harrison from Calgary in Canada, "but there is something to be said for the beauty of the simplest things of their kind." He then recalled how 1 + 1 = 2 was the first equation he taught his son. "I remember him holding up the index finger of each hand as he learned the expression, and the moment of wonder when he saw that the two fingers, separated by his whole body, could be joined in a single concept in his mind."

Other simple equations that were proposed included $v = H_0 d$, which Edwin Hubble composed in 1929 to describe the fact that the galaxies are moving away from us at a speed v that is proportional to their distance d, where H_0 is the Hubble constant. Balagoj Petrusev, an undergraduate student at the Institute of Physics in Skopje, Macedonia, suggested the Hamiltonian variational principle in the form $\delta S = 0$. A proper selection of the form of S articulates "a universal principle that stands true in classical mechanics, classical electrodynamics, relativistic mechanics, non-relativistic quantum mechanics and so on".

One of the most frequently mentioned equations was Euler's equation, $e^{i\pi} + 1 = 0$. Respondents called it "the most profound mathematical statement ever written", "filled with cosmic beauty", and "mind-blowing". Another asked: "What could be more mystical than an imaginary number interaction with real numbers to produce nothing?" The equation contains nine basic concepts of mathematics in a single expression. These are: e (the base of natural logarithms), the exponent operation, π, plus (or minus, depending on how you write it), multiplication, imaginary numbers, equals, one, and zero.

Practicality

Many respondents were impressed by equations that have a practical influence on human life. These included: the compound-interest equation, income-tax formulae, the simple ratio a/b = c/d, which is basic to construction, surveying and so forth, simple electrical equations, such as V = IR, basic mechanical equations, such as work done = force x distance, Shannon's capacity equation, which relates to the modern world through the Internet and digital communication, and, last but not least, Pythagora's theorem.

Roger Bailey nominated the "sunrise equation" cos(time) = -tan(lat) x tan(dec), which identifies the time of sunrise or sunset as a function of latitude and declination. This, he pointed out, is "fundamental to our sense of time" and it "fits on a T-shirt". Engineer John Wilcher suggested the ideal-gas law, PV = nRT, pointing out that "the relation of pressure, volume and temperature is relevant to almost everything we do", including common but often overlooked uses such as car tyres, angioplasty procedures and oil drilling.

1. *Read the first part of the text and try to explain the difference between* ***formula, theorem and equation.***

2. *Read the parts entitled* ***Simplicity and Practicality*** *and list several reasons that were important for the respondents who nominated specific equations.*
   a)……

   b) ……

   c) ……

   d) ……

3. *If you were among the respondents, which equation would you choose?*.....

   Summary

   There are several summaries of the text. Try to choose the best summary and explain why other summaries are not so good.

   A) Dr. Robert P. Crease once asked readers of Physics World magazine, which equation was the greatest for them. He received more than one hundred replies and fifty different opinions. People nominated very complicated equations, that describe much more complicated phenomena, but also equations simple and well-known. It is not easy to choose from them the greatest one, because everybody finds something different as the most important.

   B) Which equations are the greatest? Answer to this question is not simple. A great equation "reshapes perception of the universe". Many prominent scientists have their own favourite equations such as, for example Euler's equation, Schrödinger equation or the Pythagorean theorem. But for many people the greatest equation is "1 + 1 = 2" – the fairy tale of mathematics.

   C) Equations describe a lot of processes of the universe and it is not easy to choose the greatest one. And this was the question for readers of Physics World magazine. Prominent scientist Mr. Harrison chose 1 + 1 = 2, which is easy to understand. And dr. Brian Greene preferred Einstein's general relativity equations and Schrödinger equations, and another 50 different equations were chosen.

   D) The article sorts the problem of equations. Which one is the greatest one and why.

   E) A survey among readers of Physics World magazine tried to find the greatest equations. Although no equation became a "winner", the readers usually voted for simple equations with only a few symbols but very important for further development of mathematics or physics.

What is a Summary?

(adapted from http://web.uvic.ca/Notes/Howto WriteSummary.html)

A summary is the --n---- and ---i--- form of the -------l passage, written in your very own -----.

In summarizing, you want to capture the essence of what the author has said but in fewer words, Summary provides the gist – essential elements and arguments.

A. Steps

How do you proceed when you want to write a summary? Put the following steps in order.

a)Go through the original again, this time crossing out any underlined material that you realize is not essential.

b) Reread the original, underlining essential information as you go. Focus on the purpose statement (if there is one) and the topic sentences in each paragraph. Try to summarize each paragraph in a sentence.

c) Draft your summary in your own words. Include everything you are left with, even if you know there is too much. You can revise it later.

d) Now edit your own version for conciseness. Cross out any words that are not doing any work. Wherever possible, merge related ideas into single, concise sentences.

e) Copyedit your summary. Check the clarity of your sentences and paragraphs. Use transitions (as a result, next, however, etc.) as needed to make sure the ideas flow logically.

f) Read the entire original once (or twice if necessary) without making notes. You cannot write a summary of a text you do not fully understand. If some parts of the original are still not clear, go back and read them again. Some writers find it helpful to try to describe the key points in what they have just read.

g) Go back to the original and check that you have preserved the essential information without adding any new content.

h) Start with a sentence naming the writer and article title and stating the essay's main idea.

B. Characteristics of an effective summary. Are the following statements true or false?

a. The same order of facts and ideas as the original.
b. Different sentence patterns from the original.
c. Additional information, which the original writer omitted but which helps an understanding of the subject.
d. A personal comment on the subject.
e. Long explanations.
f. Definitions.

g. Major findings.
h. Data of questionable accuracy.
i. Identification of key points in the original.
j. Conclusions and recommendations.
k. Name of the author and title of the source in the introductory part.

C. Language

When writing about something you have read, you will often want to refer to what the writer says. The word "says", however, is a neutral one. Some other words can be used to indicate an author's writing or argument strategy. For example: If, instead of writing "the author says", you write "the author compares" or "the author defines", your reader will know something about how the author develops his or her ideas.

Classify the words according to their meaning.
states - remembers – argues - correlates - makes fun of - believes - writes - approves of - comments - contracts - recommends

declares, asserts ……..
notes ……..
compares …….
suggests, advocates ……..
ridicules, laughs at, pokes fun at …….
remarks, claims …….
connects ……
applauds, agrees, favours ……..
criticizes, complains, disapproves of, is shocked by ……..
reasons, recalls ……
thinks, decides ……..

Present tense
These words are all in the present tense. This is one of the conventions of academic writing. Even though the author wrote the book or article in the past, you are reading it now, and so, in a sense, the author is talking to you now.
Examples:
The author **criticizes** the president for failing to review this problem more thoroughly.
The author **recalls** an event that took place years ago.
The author **attempts to persuade** the reader to support his cause.
Although the author **assures** the reader that he has researched his topic, he does not document his evidence.

Transition words
Transition words show how ideas are connected to each other, helping the reader follow the writer's train of thought. What do these words indicate? (*order, cause-effect, comparison, contrast, level of certainty, additional information…*)

although however while nevertheless but still
since because consequently thus briefly in conclusion
on the other hand in contract comparing then therefore so that
certainly obviously of course likewise similarly moreover furthermore
in addition for example in other words next later finally