PHYSICS GRADs vs. PROFs CHALLENGE

For Physics Block Party on 1 September 2015:

ROUND 1:

This round has short answers of one or two words. The panelists are to just speak the answer out loudly, with the points going to the first person on either side to state the answer correctly. I instruct the audience to keep quiet, as your time will come later. The first correct answer is worth +2 points.

POINTS AWARDED:

2-Grad **(1)** **(2 points)** What branch of physics is the specialty of the Bond Girl Christmas Jones?
Nuclear physics
Hint **(for 1 point)**: Christmas Jones met James Bond in the movie "The World Is Not Enough" at a Russian ICBM missile base

2-Prof **(2)** **(2 points)** Who was named as the Person of the Century by Time magazine in 2000?
Albert Einstein

no points (by Bits) Suppose that we have a simple pendulum 10 meters long and give it a small push. To within 10%, what is its period of oscillation?
6.345 seconds (P = 2!*SQRT(L/g) Accept 5.713 sec to 6.979 sec

2-Grad **(4)** What is the only element in the Periodic Table that is pronounced as six syllables?
Praseodymium (59)   pray-zee-a-DIM-ee-um

2-Prof **(5)** The very popular television show Bonanza, set in Silver City Nevada around the 1870s had one episode covering the early life of what famous US physicist?
Albert Michelson
Hint (for 1 point):   In the episode, Ben Cartwright got him an appointment to the US Naval Academy, where he went on to spend his career, working with Simon Newcomb, and measuring the speed of light.

2-Prof **)** How many editions has the book Classical Electrodynamics by Jackson gone through?
Three (3) editions, the last in 1998.

2-Prof **(7)** What physicist has won the Nobel Peace Prize?
Linus Pauling (1962, anti-nuclear testing activism)

2-Prof **(8)** Who is the other physicist that has won the Nobel Peace Prize?
Andrei Sakharov (1975, human rights in USSR)
Prof. Rau points out that Joseph Rotblat (1995 Peace Prize) is also a physicist.

(6

2-Prof   **(9)** **(2 points)** What <u>movie</u> had Kip Thorne as a scientific consultant and executive producer?

              Interstellar (plus many documentaries and TV series)

2-Grad   **(10)** **(2 points)** Here, I am wanting the exponent of a dimensionless number, that is the nearest power of ten to within one order of magnitude. How many electrons are there in my brain?

ROUND 2:

For this round, both teams are to consult together, write out their answers on a page, and then reveal their answers together. Each correct answer is worth 3 points.

no points **(15)** **(3 points)** To within two orders of magnitude, what is the Schwarzschild radius for an electron?

1.36×10^{-55} cm $= 1.36 \times 10^{-57}$ m. ($R_{Sch} = 2 * G * m_{electron} / c^2$) Accept 10^{-53} to 10^{-57} cm

3-Grad
3-Prof   **(16)** **(3 points)** Reportedly, Lady Stacy Bright made a fabulous and unexpected discovery that earned her the Nobel Prize in Physics in the year 2058. What was that discovery?

Travelling faster than the speed of light
or Time travel to the previous night
> The well-known limerick is:
>> There was a young lady named Bright,
>> Whose speed was far faster than light;
>> She set out one day,
>> In a relative way,
>> And returned home the previous night.
> As a side connection, an LSU undergraduate student named 'Stacey Bright' was widely known, and she now is in Sydney Australia as a graduate student working with Orsala de Marco (another frequent collaborator with LSU people).

no points **(17)** **(3 points)** What is the critical mass for U-235?

52 kg or 115 pounds (17-cm radius). To 10%, accept 46-57 kg or 104-127 pounds
> Critical mass for U-233 is 15 kg (11 cm diameter)
> Critical mass for Neptunium-236 is 7 kg (8.7 cm diameter)
> Critical mass for Californium-251 is 5 kg (8.5 cm diameter)

This turned out to be an ill-posed question. During the Challenge, several of the profs objected to the above answer. Prof. Rau knew that the critical mass was much smaller, while Prof. Dowling used his phone to search and find a critical mass of 15 kg. The problem is with the definition of 'critical mass'. The values I quote above are for a spherical mass isolated from everything. This is arguably the best and most unique definition. (Even so, a simple 50 kg sphere brought together might go critical, but it will largely blow itself apart before much energy is produced and the bomb will be a dud.) But various conditions can make for smaller masses going critical. For example, if you put a heavy neutron-reflecting tamper around the uranium, then you only need 15 kg to go critical. For the smallest critical mass with the U-235 in aqueous solution with an optimal moderation, you only need 0.78 kg, even though this will not give much of an explosion. In all cases, the Professor's offered answer of "2 kg" was not acceptable.

3-Grad
3-Prof
(18) (3 points) This Cadbury Easter Egg has 150 calories. If you are 100 kilograms in mass, how high would you have to climb to work off these calories?

600 meters = 2000 feet = 656 yards, accept anything from 300-900 meters, or 1300-2600 feet (up to half a mile)

For 100kg person (220 pounds); 150 kCal = 6.3e12 erg = MgH.

H = 6.3E12/(1e5gm * 980 cm/s/s) = 6e4 cm = 600m

The GRADs answer was 30 stories or floors, which is ill-defined yet meaningful. For a 10-25 foot height to a 'story' gives the unacceptable answer of 300 feet to 750 feet. Unfortunately during the Challenge, I mistakenly said that the '30 stories' answer was acceptable, and they were awarded 3 points. Fortunately, this makes no difference in the outcome.

no points **(19) (3 points)** Riddle-me-this:

Newton used me to make attractive bodies

Newton also used me to make opposing forces

ROUND 3:

For the third round, I will give a series of questions, often related, and I will alternate back and forth between teams. Each correct answer is worth +4 points.

For the third round, we will have 3 'lifelines', where a panel can try to get further help; **(1)** getting the audience to shout out answers for them, or **(2)** by explicitly asking one person in the audience, with this person being instructed to give their possible answer, or **(3)** by asking for a hint from me. Each team gets to use each type of lifeline just once.

*** **(4 points each)** Name a physicist who has won *TWO* Nobel Prizes

4-Grad   Marie Curie-   Physics in 1903 (radioactivity)
                      Chemistry in1911 (radium & polonium)
                      Hint: She won one of her Nobels in Chemistry in 1911

4-Prof   John Bardeen   Physics in1956 (invention of transistor) &
                      Physics in 1972 (BCS superconductivity model)
                      Hint: He won two Physics Nobels, in 1956 and 197

Hint: Kim Stanley Robinson wrote a good SF book on this.
Jupiter [point out the Thor=Jupiter equivalency, allow another answer]
Saturn [point out the Titan

4-Grad *** **(4 points)** What is the largest European nation not to have an element named after it?

Ukraine [with or without the Crimea]

Hint: