

2009 LSU-PHYSICS IQ TEST

More than one answer might be correct, or none . . . Circle the correct answer(s).

Name:

(1) Many new graduate students are starting here in our Department this August?

- A. 8
- B. 14
- C. 19
- D. 27
- E. 35

[For extra credit, tell me how many countries are represented with their citizens?]

(2) You are headed exactly north on a flat road riding a bicycle at 10.0 mph. Suddenly a wind springs up exactly from the east at 10.0 mph. Across this transition, you keep exerting the same energy into the pedals. How does your velocity change and what is the correct dominant effect?

- A. Your velocity remains constant (the wind is neither a headwind nor a tailwind).
- B. Your velocity speeds up (in the wind's rest frame, you are moving backwards).
- C. Your velocity slows down (wind resistance force goes like the square of the relative velocity).
- D. Your velocity slows down (in your reference frame, the wind is a headwind).
- E. Your velocity remains constant (the north/south component of the wind force remains constant).

(3) The *Star Trek* movie that just came out shows the origins of many of the most famous and iconic characters of our time. Each of these characters has well known traits (Kirk as a direct action person, Spock as being logical and smart, and so on). For this question, your task is to select one person from our Department to best match the personality traits for each of the five characters. You must choose from: Andrew **COLLAZZI**, Rachel **COLLYER**, Arnell **DANGERFIELD**, Jon **DOWLING**, Ophelia **DUDLEY**, Shannon **FRITZ**, Rongying **JIN**, Kip **MATTHEWS**, Beverly **RODRIGUEZ**, Ilya **VEKHTER**, Sai **VINJAMAMPATHY**, and Jiandi **ZHANG**. I will tabulate all answers to this question, and the Department person voted to be the best match to the character's personality traits will become the 'right' answer. So put down the persons who you think that the most other people will put down.

- A. Captain Kirk
- B. Mr. Spock
- C. Dr. McCoy
- D. Lt. Uhuru
- E. Ensign Sulu

- (4) How many times has the Block Party been postponed due to a hurricane hitting near the planned party date?
- 1 [Gustav]
 - 2 [Katrina, Gustav]
 - 3 [Katrina, Gustav, Ike]
 - 4 [Katrina, Rita, Gustav, Ike]
 - 5 [Andrew, Katrina, Rita, Gustav, Ike]
- (5) Place an ordinary ice-cube into a microwave oven at full power. (Assume that the ice-cube is placed on an insulator, like cardboard, so any melt water can drain away.) What happens?
- The ice-cube will blow up in ~30 seconds provided it is not fractured [interior water vaporizes].
 - The ice-cube will melt in ~14 minutes [microwave frequency not tuned to water in ice crystal].
 - The ice-cube will melt in ~3 minutes [microwaves work on trace melt water which then melts the ice].
 - The ice-cube will melt in ~20 seconds [microwaves boil water cup in ~2 minutes, so ice-cube in 20 sec].
 - The ice-cube will get smaller and vanish in ~1 minute with no water melt [ice sublimates to gas].
- (6) How many neutrinos from SN1987A interacted inside human eyes so as to create a possibly visible flash? Some fast facts for your calculation are that neutrinos pass easily through a light year of lead (with optical depth ~0.1), the LMC is 170,000 light years away, and a neutron star has $\sim 3 \times 10^{33}$ gm in mass. Or, you could estimate how many eyeballs can be smashed (perhaps by professional peasant grape-stompers) into the Super-Kamiokande detector.
- 10^{-1}
 - 10^2
 - 10^5
 - 10^8
 - 10^{11}
- (7) Our Department has had a number of recent marriages, with each of the people listed below 'tying-the-knot' recently. Place them in time order (first to latest):
- Becky Ringuette and Chris
 - Chris Britt and Bonnie
 - Jan Staff and Kuriko
 - Robert Hynes and Jo
 - Sarvnpun Chawla and Deepie

First

Most recent

- (8) Sco X-1 is the first and brightest x-ray source in our sky. If you were an unprotected astronaut in space (i.e., no protective suit, spacecraft, or atmosphere) on some mission, then how close would you have to be to get a lethal dose? In case you don't remember your astromedicophysics basics, Sco X-1 is 9000 light years away, emitting 10^{38} erg/s in what can be idealized as 10-keV photons, and a chest x-ray delivers $\sim 10^{13}$ photons. So what is the 'kill-radius' of Sco X-1?
- A. ~ 1 Astronomical Units [i.e., only close-in atmosphere-less planets would have trouble].
 - B. ~ 300 Astronomical Units [i.e., the kill radius is only a bit larger than our Sun's whole Solar System].
 - C. ~ 30 light years [i.e., airless planets around the many stars near to Sco X-1 are sterilized].
 - D. ~ 9000 light years [i.e., astronauts in our Solar System need protection from Sco X-1].
 - E. $\sim 90,000$ light years [i.e., Sco X-1 by itself will sterilize the Milky Way for anything unprotected].
- (9) The 'bounce rocket' is an analogy for how the falling core of a collapsing star will bounce off itself to blast out a fraction of the mass at very high velocity. The bounce rocket is simply where two bouncy balls are dropped together, with the much larger bouncy ball immediately below the much smaller bouncy ball. To be specific, suppose that a bounce rocket (say, a tennis ball on top of a basket ball) is dropped from a height of 2.0 feet, then how high will the smaller ball fly up to? Assume perfectly elastic balls.
- A. 2.0 feet [i.e., conservation of energy requires that it bounce no higher than it is dropped].
 - B. 4.0 feet [i.e., twice as high as it was dropped].
 - C. 6.0 feet
 - D. 18.0 feet
 - E. 53.9 feet
- (10) In homage to Enrico Fermi, roughly, how many barbers *are* there in Baton Rouge?
- A. ~ 10
 - B. ~ 30
 - C. ~ 100
 - D. ~ 300
 - E. ~ 1000