Extra Credit Quizzes&Review for Final

<u>Extra credit quizzes (10):</u>

1) A heat engine produces 100 J of work and releases 300 J of thermal energy exhaust. Its efficiency is
(a) 20%   (b) 25%   (c) 10%   (d) 33%   (e) 50%

2) Assume the O (oxygen) atom is twice as heavy as atom A. How much AO_2 do you produce if you burn 1 ton of A?
(a) 3 tons   (b) 1 ton   (c) 5 tons   (d) 2.5 tons   (e) 2 tons

3) A roller coaster crosses a 50 m high hill with a speed of 10 m/s. Compare its kinetic energy at the top of that hill with its gravitational potential energy (relative to the ground) at that point.
(a) E_{kin} is 5 times $E_{potential}$
(b) They're the same.
(c) $E_{potential}$ is 5 times E_{kin}
(d) $E_{potential}$ is 10 times E_{kin}
(e) Can't answer without knowing its mass.

4) A car weighing 10,000 N moves along a straight, level road at a steady 100 km/hr. Air resistance is 300 N, and rolling resistance is 400 N. The net force on this car is

(a) 10,000 N   (b) 9,300 N   (c) 10,700 N   (d) zero   (e) 700 N

5) A particle moves down through the atmosphere at a speed such that we measure its mass to be double its rest mass. From its perspective, i.e. if we were moving with the particle, the thickness of the atmosphere will

(a) remain the same as for a ground-based observer.

(b) shrink to half of what the ground-based observer would measure.

(c) double compared to what the ground-based observer would measure.

(d) depends on the particle's actual mass.

(e) none of the above.

6) Suppose you have a neutron and a proton some distance d apart. You double the distance to 2d. As a result,

(a) their *attractive* gravitational force doubles, and their *attractive* electric (Coulomb) force also doubles.

(b) their *attractive* gravitational force decreases by a factor of 4, and their Coulomb force remains zero.

(c) their *attractive* gravitational force decreases by a factor of 2, and their Coulomb force remains zero.

(d) both their *repulsive* gravitational force and their *repulsive* Coulomb force decrease by a factor of 4.

(e) None of the above.

7) An atom has the following four energy levels. The spectral lines are all visible, except for one in the infrared (IR). The quantum jump that produces the IR line is
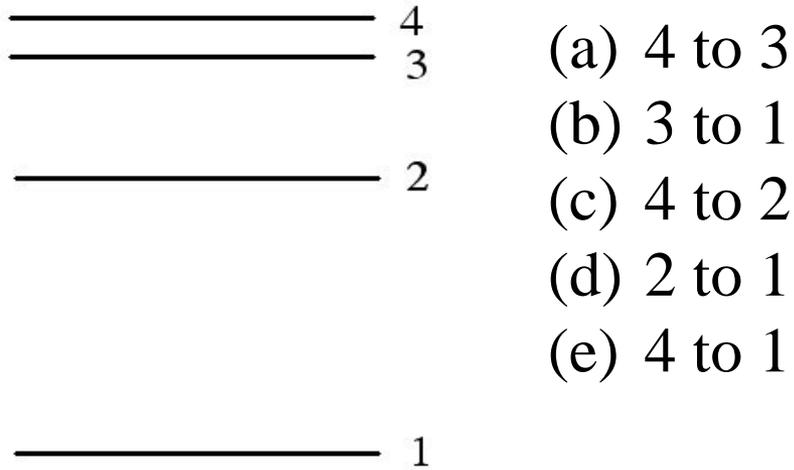
(a) 4 to 3
(b) 3 to 1
(c) 4 to 2
(d) 2 to 1
(e) 4 to 1

8) The mass of a ^{3}He nucleus is

(a) $= 2m_{proton} + m_{neutron}$

(b) $= 2m_{neutron} + m_{proton}$

(c) $<$ (a)

(d) $>$ (a)

(e) none of the above

9) Two bar magnets are sticking to each other. You put work into this system and pull them apart. As a result
(a) you've increased the rest mass of the 2-magnet system.
(b) you've increased the mass, but not the rest mass of this system.
(c) you've increased both mass and rest mass of this system.
(d) you've decreased the mass of this system.
(e) none of the above.

10) You push a box up a ramp at *constant* speed. We're not ignoring friction. The work you do on the box manifests itself in
(a) a change of $E_{kinetic}$ and in some $E_{thermal}$.
(b) a decrease in $E_{gravitational}$.
(c) an increase in both $E_{gravitational}$ and $E_{kinetic}$.
(d) an increase in $E_{gravitational}$ and in some $E_{thermal}$.
(e) just some $E_{thermal}$ and no other energy changes.