Batman the Movie (1989)

1. In a back alley of Gotham, a tourist family is mugged, and the mother and son threatened. Shortly thereafter, the crooks who swiped the husband's wallet are accosted by costumed vigilante, that resembles a giant bat. The vigilante tells one of the crooks to tell his friends about him. When the crook pleads to know 'what' this creature is, what does the costumed man reply?
2. When the two crooks are found by the Police, Lt. Eckhardt shows up at the scene. How does he react about the crook's description of a man dressed like a bat?
   Who is Alexander Knox?
3. Who is Harvey Dent?
4. Gotham City will be celebrating an anniversary. What anniversary are they celebrating?
5. Back at the Gotham City newspaper, Knox meets one of the paper's new photographers, Vicki Vale. Knowing that the Police Commissioner has a file on the Bat vigilante, Knox and Vale intend to get into a charity benefit at Millionaire Bruce Wayne's mansion. What is the Commissioner's Name?
6. Who is Carl Grissom and how is he related to Axis Chemical Plant?
7. How is Jack Napier related to Carl Grissom?
8. What is the Name of Bruce Wayne's Butler?
9. What is the relationship of Batman and Bruce Wayne?
10. Why is Jack Napier sent to the Axis Chemical Plant? What does he find in the safe? What was his conclusion?
11. Does the Commissioner want Jack Napier alive or dead?
12. During a chase scene at the Axis Chemical Plant, Batman corners Napier and Napier falls. What does Napier fall into?
13. Afterward, Jack Napier has managed to survive, and makes his way to a seedy doctor to have his face repaired. How does the incident affect Jack Napier's face and hair?

14. The Joker claims that Grissom has gone away for awhile, and has left him in charge. Claiming to oversee all of Grissom's affairs, the other crime bosses are not convinced, and still fail to acknowledge this, even when the Joker electrocutes one of their own. Apparently, the Joker is able to electrocute/fry a man by touching him with an electric buzzer in his hand.

a. Is it possible for the Joker to electrocute somebody with a handshake, without electrocuting himself? (Note: You need an extremely high voltage difference for electricity to flow through an electrical resistant human)

b. Do you think the Joker could invent a device to electrocute/fry an individual with a remote hand device? (Note: To fry a person like that, you would need at least 20-30 amps. An entire household will pull 20 Amps) Explain.

15. Eventually, one of the crime lords attempts to go public, holding a press conference saying that Grissom has left and his associates (not including the Joker) control of Grissom's Empire. It is then that the Joker appears, and stabs the crime lord, before driving off. Where does the Joker stab the crime lord?

16. Using an unknown (to the viewer) combination of chemicals, the Joker creates a chemical known as 'Smilex'. The Chemical will kill anybody with laughter and leave a permanent Smile on their face. How doe s the Joker plan to introduce this poison to the general public?

17. Shortly after this, Vicki Vale receives a request from Bruce Wayne to meet him at the Gotham Museum of Art. When she gets there, she finds a table reserved, and receives a gift box. What does she find in the gift box? Why?

18. At the museum, Batman swoops in through the skylight, and makes off with Vale. The Joker's goons give chase, following the Bat-mobile through Gotham. In one scene, Batman shoots a cable into a building to aid him in making a tight turn. This was a pretty good idea. Explain how this is done? Calculate the Tension on the cable by using the centripetal force formula: $F_c = mv^2/r$

    Assume m = mass of the Bat-mobile = 1400 kg;
    v = speed of the Bat-mobile = 50 mph = 81 km/hr = 22.5 m/s
    r = 8 meters.
    Note: You'll end up with a unit in Newtons . Find the LBS: (Use 4.45 N = 1 LBS)

19. Arch-villain, chemistry whiz, and borderline psychotic, The Joker takes over Gotham's underworld, and is terrorizing the city by initiating an unprecedented wave of criminal rerror in the already decaying and crime-ridden city. The Joker's particular talent, in addition to his creatively morbid sense of humor and his highly developed sense of the theatrical, is an ability

to concoct a variety of insidious deadly poisons that he unleashes on the public in a variety of unexpected ways. The Joker also has it out for Batman, who is committed to putting an end to the reign of terror perpetrated by the Joker and his minions.

a. Batman first, by using a remote control, sends the Bat-mobile to Axis Chemicals, in hopes of blowing up all of the Joker's activities. While he destroys the facility, the Joker was not in the building at the time. However, it doesn't appear that Batman is not within viewing distance of the Bat-mobile. Is this possible with a full sized remote controlled car? Explain.

b. In the climax of the movie, The Joker has shot down Batman in his hi-tech fully loaded Bat-plane, which has gone careening into the base of a particularly ominous Gotham City skyscraper. The Joker has Batman's girlfriend, Vicki Vale, held hostage at the top of the building, and Batman must both rescue her and prevent The Joker's escape. Fortunately, despite the fact that his plane hits the ground at airplane-crashing speeds (100-200 miles per hour or so), and smashes in a fiery blaze into the building at a speed not much less than that, Batman seems to be in pretty good shape when he opens the hatch. Does the fact that the exterior of the Bat-plane is intact after the collision mean that Batman will not be injured in the crash? (Note: The body of the plane is still more or less intact, and apparently Batman has a really good system of air bags and flame retardants inside)

c. Make a rough estimate of Batman's average acceleration from the time the plane hits the ground to just before it hits the building. Use $a = (v_2-v_1)/t$

d. What forces are acting on Batman to slow him down during this time?

e. During the short collision time with the building (probably) 0.01 and 0.05 seconds), determine how much force acts on Batman to bring him to a stop. Use $F\,t = m\,(v_2-v_1)$ Also assume that Batman's mass is 80 kg.

f. How would an air bag reduce the force acting on him?

20. After chasing the Joker up to the top of the tower, they have the final showdown. Batman is clearly the better fighter, and after several crunching blows he knocks out The Joker's set of chattering false teeth, but Batman and Vale have a stroke of bad luck when the ledge on which they are standing gives way. They are left dangling over the ledge hanging on only by their fingertips. This gives Joker time to get away. Batman and Vale lose their grips and fall over ten seconds in movie time before Batman's retractable rope-hook catches on a gargoyle and abruptly stops them. The rope doesn't appear to be that flexible and their velocity plummets to zero in probably less than one tenth of a second, yet it saves them from crashing to certain death on the ground below.
    a. Under ideal conditions, (no air resistance), find the velocity just before the rope arrests their fall. Use $v = v_o + gt$ Note: $g = 9.8\ m/s^2$; $t = 10$ sec; and $v_o = 0$ m/s.

    b. Terminal velocity depends on the aerodynamics of the falling body, but somewhere around 60 m/s would be a conservative estimate for the body position in which these two people are falling. You will notice that your calculation is larger. Why?

    c. Find the deceleration for the 0.1 second that the rope brings the pair to a stop. Use the approximate terminal velocity value of 60 m/s as the velocity just before the rope catches. Use $a = \Delta v/t$

    d. How many times is your calculated acceleration compared with $g = 9.8\ m/s^2$.

    e. The forces acting on the pair are an upward force due to the tension in the rope, and a downward force due to their combined weight. Determine the tension force "F" assuming Batman has a mass of 80 kg and Vale has a mass of 60 kg. (80 kg + 60 kg) = m

       Use: Net force $= F - mg = ma$

       $F = mg + ma = m(a + g)$

    f. How this much force would affect the human body depends on the duration of impact, the accelerations of different parts of the body, and the pressure exerted on different parts of the body. Yes, Batman is smart, tenacious, and in excellent physical condition, but Batman is a normal human. It is estimated for normal humans that large bones will break when experiencing forces of about 90,000 N. A force of 10,000 LBS/45,000 N applied to smaller bones like wrists or fingers would likely be enough to shatter them. What does your calculations above tell you about injuring Batman?
    g. To make matters worse, Batman holds Vicki Lane around her waist, and he must exert a force of similar magnitude to keep a grip on her. Is this realistic? Why?