Edexcel Revision Guide – Warm-up questions - answers for all sections 1-7.

Section A: Forces and Motion

1. **a)** 7.75 m/s.

b) 0.00775 km/s.

c) 27.9 km/h.

2. **a)** 500 seconds and

b) 8⅓ minutes.

3. 39 735 360 000 000 kilometres (roughly 40 trillion kilometres).

4. **a)** Graph (b) (the steepest straight line).

b) Graph (d) (change in gradient from positive, moving away from the start, to negative moving back).

c) Graph (c) (the gradient is continuously increasing).

d) Graph (a) (straight line, less steep than graph (b)).

5. **a)** 25 m/s.

b) 3.125 m/s^2.

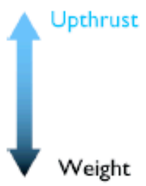
6. **a)** 3.5 m/s^2.

b) At a constant velocity of 14 m/s.

c) 140 m (area under graph = area of triangle + area of rectangle → $(2 \times 14 + 8 \times 14)$ m).

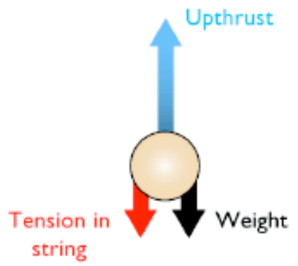
d) 7 m/s.

7. **a)**



b) The sum or resultant of balanced forces is zero as they are equal in size, but opposite in direction.

8. **a)**



Note: These forces all act along the same line passing through the centre of gravity of the balloon; they have been separated slightly to make them clearer.

b) When the string is cut the tension force will no longer act on the balloon.

c) The forces will no longer be balanced; there will be a resultant force upwards which will cause the balloon to accelerate vertically upwards.

d) As soon as the balloon starts to move it will be subjected to a (viscous) drag force opposing its upward motion through the air. This force will increase with the speed of the balloon, so the balloon will accelerate quickly at first, then more and more slowly until the three forces balance once again. The balloon will then rise at a steady terminal speed.

9. An unbalanced force can cause an object to accelerate (speed up), decelerate (slow down) or change the direction in which it is moving.

10. a) Between A and C (the straight part of the graph) Hooke's Law is obeyed. At C Hooke's Law ceases to be obeyed.

b) The elastic limit or the limit of proportionality.

11. a) 54 000 000 N (b) The drag force due to its movement through the water. (c) It must be greater than the drag force by 54 000 000 N to cause the acceleration.

12. a) 8500 N.

b) 1.9 m/s^2. (If the LEM weighed 7500 N on the Moon, its mass = weight ÷ Moon gravity, approx 4490 kg).

c) As the rocket expels the products of burning fuel, the mass of the rocket decreases; if the thrust is constant then the acceleration will increase.

13. 0.008 kg (or 8 grams).

14. a) Car C. It has the largest area under the graph line.

b) Car A. The horizontal section of the graph shows no braking (constant velocity) because the driver has yet to react to the hazard – in the graph for car A this is the shortest. The reaction time for the other two graphs could be because the driver was tired, under the influence of alcohol or other drugs, was distracted by use of a mobile phone or because visibility was poor (any two).

c) If you cannot see the car in front you cannot ensure you have left enough braking distance and you are likely to take longer to realise that there was an emergency stop required. The faster you are going and the longer you take to react (graph C) the greater the distance needed to come to a halt.

d) The slope of the braking part of the graph would be less steep because you could not brake as hard without skidding. This would mean that the total stopping distance (thinking distance + braking distance) would be greater still.

15. a) The hammer and feather hit the Moon's surface at the same instant. It showed that in the absence of an atmosphere, all objects fall with the same acceleration.

b) The hammer would hit the ground after a shorter time than it did on the Moon, because the Earth's gravity is about six times stronger than the Moon's. The feather would also accelerate more quickly, but the effect of air resistance would mean it soon reached a terminal velocity and therefore took noticeably longer to reach the ground.

16. a) The acceleration is virtually constant because the resultant force on the object is virtually constant.

b) When the speed of the object increases, the drag force due to air resistance increases. Eventually this becomes significant and the resultant force becomes noticeably smaller – so too does the acceleration.

c) The terminal velocity.

d) Zero. The forces on the object are balanced.

17. **a)** 30 kg m/s.

b) The same, 30 kg m/s, but in the opposite direction.

c) 0.3 m/s.

18. 3.2 m/s.

19. **a)** 360 000 N.

b) The average force is now only 28 800 N. Large decelerations involve huge forces – these are transmitted to the human occupant, when they hit the windscreen for example, and cause extensive damage to bones and internal organs.

20. Although it is clearly the astronaut who is doing the throwing she cannot apply a force to the box without experiencing a force herself, equal in size (magnitude) but opposite in direction. The force she feels is the reaction force to the action force she applied on the box.

21. Least (d), (force acts through the turning point or pivot so turning moment is 0). Next (c) (because it is clearly less than (a) and (a) is just less than (b): (d), (c), (a), (b).

22. **a)** The order is (d), (a), (b), (c).

b) The most stable object is (d) and (c) is the least stable.

23. 400 N (left-hand diagram); 300 N (right-hand diagram).

24. The Sun generates energy in the form of light (and heat of course) by the continuous fusion reaction going on; the Moon merely reflects some of the Sun's energy back to Earth.

25. **a)** The gravitational force of attraction between objects which have large mass.

b) The order is (c), (a), (b). The more massive the bodies and the closer they are together, the bigger the gravitational force attracting the bodies is. (c) exerts a smaller force on the satellite than (a) because the satellite is further away; (b) exerts a larger force on the satellite than (a) because it has greater mass.

26. **a)** 10 N and 1 kg; on the Earth a mass of 1 kg experiences a force due to gravity of approximately 10 N. Both spring balances are correctly calibrated for use on the Earth.

b) 1.7 N and 0.17 kg; the gravitational field at the surface of the Moon is about one-sixth of that at the Earth's surface. The mass is still 1 kg but the spring balance calibrated on the Earth will give a false reading; this is because the extension of the spring depends on the *weight* of the 1 kg mass.

27. Our solar system is made up of a *star* called the *sun* which is orbited by a number of *planets*. Some of these planets have *moons* orbiting them, including the Earth. There are billions of *stars* in the our *galaxy* which is called the Milky Way. The universe itself is made up billions of *galaxies*.

28. A is a galaxy, B is a comet, C is a star, D is a planet.

Remember that the comet has the 'tail' and eccentric orbit. The planet Saturn has rings and a galaxy is a huge group of billions of stars.

29. A is the orbit of a planet, B is the orbit of a comet. Comets have highly eccentric orbits, planets have orbits that are nearly circular.

30. Earth orbital speed: 108 000 km/h, 30 000 m/s.

Mercury orbital speed: 1.8 million km/h, 480 000 m/s. [All figures rounded to no more than 3 sig. fig.]