Edexcel Revision Guide – Exam-style questions - p92 onwards– answers for all sections 1-7.

Section A: Exam Style Questions – Answers

1. a) Average speed = Distance travelled ÷ Time taken [1].

b) i) 12.6 km/h [1].

ii) 3.5 m/s [2] (a method mark if the answer is wrong but an attempt has been made to convert km → m and hours → seconds).

c) i) Slowing down (decelerating) [1] (ii) at rest [1] (iii) constant speed [1] (then stopping suddenly at 3.5 hours).

d) To calculate the distance covered by the runner in the period AB, you need to find the area under the graph line up to the time at point B [1]. You need to know the initial (starting) speed at point A and the final speed at point B [1].

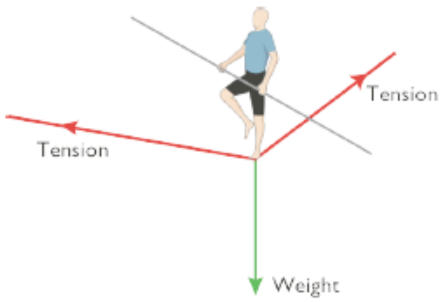
2. a) A scalar quantity has only size (or magnitude) [1]; a vector quantity has both size [1] and a particular direction [1].

b) i) A scalar quantity: mass. [1]

ii) A vector quantity: weight (force due to gravity). [1]

c) Velocity increases [1] by 1.8 m/s every second [1].

3. a)



[1] for each arrow

[1] for Tension forces labelled

[1] for Weight labelled

b) The forces are balanced [1] so there are no resultant forces acting on the tight rope walker [1].

c) Because there is no upward force [1] acting on the tight rope walker to balance his weight [1].

4. a) Sharlini should calculate the extension for each load (subtracting l_o from the readings in the table) [1] by plotting a graph of load on vertical axis [1] against extension on horizontal axis [1]. The graph should be a straight line passing through (0, 0) if Hooke's law is obeyed. [1]

b) Axes labelled [1]; all points plotted accurately [2] *or* at least 5 point plotted accurately [1]; line of best fit drawn [1].

c) No [1] because the graph does not pass through the origin [1] and the last point of the graph does not follow the straight line [1].

d) The spring has not returned to its original length [1]. It has been overstretched/stretched beyond its elastic limit [1].

5. a) 30 cm/s [2] (1 mark for correct method if answer is wrong).

b) Travelling at constant speed (or velocity). [1]

c) i) Tape B reveals that the car is speeding up [1] because the spacing between the 'ticks' is decreasing [1].

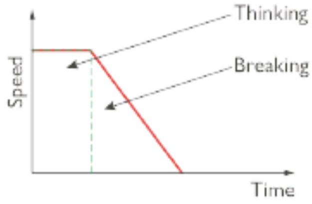
ii) The end toward which the car is travelling has been lowered so that the car is now travelling downhill. [1]

d) i) Tape C reveals that the car is slowing down [1] because the spacing between the 'ticks' is increasing [1].

ii) The end toward which the car is travelling has been raised. [1]

$F = ma$, $m = 1.2$ kg and $a = 0.045$ cm/s^2 [1] Correct substitution into equation [1] with correct answer of $F = 0.054$ N. [1]

6. **a)**



b) B: Speeding [1]; the speed during the thinking time is greater [1].

C: Braking less effective, due to poor tyre condition or adverse weather [1]; smaller slope during braking section [1].

D: Slower reaction time, due to alcohol/drugs/tiredness etc... [1]; horizontal section of the graph is longer.

c) Divide the graph into rectangle (thinking distance) and triangle (braking distance [1]. Then find the areas of each [1] and add them together to find the total stopping distance [1].

7. **a)** $a = F/m$ [1] Correct substitution into equation [1] with correct answer of 11.33 m/s^2 [1] (Correct answer gets [3] otherwise the examiner then looks for method marks.)

b) time = increase in velocity/acceleration [1] Correct substitution into equation [1] with correct answer of 988 s. [1]

c) Mass of the rocket decreases [1] as fuel is burnt so acceleration will increase [1] *or* air resistance increases with speed [1] so net accelerating force decreases [1] *or* thrust from rocket motor is not constant [1] reduced thrust smaller acceleration [1].

8. Up to time t_1: Straight line indicates constant acceleration [1] because air resistance is negligible [1] so the net accelerating force is constant [1].

$t_1 - t_2$: Acceleration decreases (gradient getting smaller as graph curves) [1] because air resistance increases with speed [1] so net accelerating force gets smaller [1].

$t_2 - t_3$: Parachute opens [1] causing the air resistance to exceed the weight [1] and parachutist decelerated to a lower terminal velocity [1].

9. **a)** momentum = mass × velocity [1].

b) Total momentum is conserved during collisions (and explosions) [1] if there are no forces acting on the colliding bodies other than the forces each exerts on the other (no external forces act on the colliding bodies) [1].

c) Momentum before: 20 kg × 5 m/s = momentum after: 20n kg × 1.25 m/s where n is the number of trolleys moving off together after the collision. [2 for method and substitution of values]; n = 4 [1]; therefore there were 3 trolleys in the stack [1].

10. a) In an elastic collision objects rebound [1] without loss of kinetic energy [1]. In an inelastic collision objects do not rebound but stick together [1]. In a partially elastic collision objects rebound but there is a loss of kinetic energy [1] (energy is transferred in the form of heat and sound to the surroundings).

b) i) Inelastic: A fly hitting the windscreen of a car (and very much sticking to it). [1]

ii) Partially elastic: A ball bouncing on the ground [1] (it rebounds but with less KE than it started with).

11. a) i) Diagram b, during collision. [1] (Each body exerts a force on the other and experiences an equal and opposite reaction.)

ii) Diagram b [1] and diagram c [1]. (The balls are either moving in a straight line at constant speed or are remaining at rest.)

iii) (Assume that the balls both have mass m.) The change in momentum for the red ball is $mV_R - mU_R$ and since $U_R = 0$ the <u>change (increase) in momentum of the red ball is mV_R</u> [1]. Similarly for the blue ball change in momentum is $m(V_B - U_B)$ [1]. The gain in momentum of the red ball is equal to the loss of momentum of the blue ball [2].

b) i) If $V_R = U_B$ then $mV_R = m(V_B - V_R)$ [1] therefore $V_B = 0$ [1] (blue ball comes to rest).

ii) Elastic [1] since kinetic energy is conserved [1].

12. All three safety systems are designed to cause the people in the car to be brought to rest over a longer period of time [1] than the car they are in, which may be brought to rest within a very short period of time. Since deceleration is defined as the decrease in velocity divided by the time taken to come to rest [1], increasing the time period reduces the size of deceleration experienced by the people in the car [1]. Reducing deceleration reduces the forces which act on the people [1] (since F = ma).

13. a) It is subject to a resultant force [1] because it is continuously changing direction [1] (continuously accelerating towards the Earth).

b) i) A trampolinist is subject to a resultant force at the lowest point of his bounce [1] due to the stretching of the trampoline bed [1].

ii) A trampolinist is subject to the resultant force of gravity at the highest point of his bounce. [1]

c) No resultant force [1] as there is no acceleration.

14. a) Weigh 100 pellets [1] and divide the mass by 100 [1].

b) Inelastic. [1]

c) KE of mass of block + bullet at the start of the swing [1] is equal to GPE of the balance as it comes to rest at its highest point in the swing [1]. So, $\frac{1}{2}(m + M)v^2 = (m + M)gh$ [1].

d) Total momentum before the collision is mu since the block is at rest. [1] Immediately after the collision the total momentum is $(m + M)v$ [1]. Equating these give $u = (m + M)v/m$ [1].

e) The collision is not elastic [1] (it is inelastic). Energy is transferred to heat and sound, not only to the block as KE [1]. The answer will be smaller than the actual speed of the pellet [1].

15. a) Each will move away from the other [1] along the same straight line [1] at different speeds [1].

b) Although Jane is the one doing the active pushing she will also experience a force equal in size, but acting on her, in the opposite direction to the force she has applied to Chris. (According to Newton's 3rd law). [1]

Each will experience the same size of momentum change but in opposite directions, hence they move away from each other [1]. Chris has more mass than Jane so he will move more slowly [1]. (The figures given in the question do enable you to work out their velocities after the push, but the question only asks for a *qualitative* answer.)

16. a) Moment of a force = F × d [1]. The diagram should clearly show distance d from pivot [1] and that the distance is the *perpendicular* distance to the line of action of the force [1].

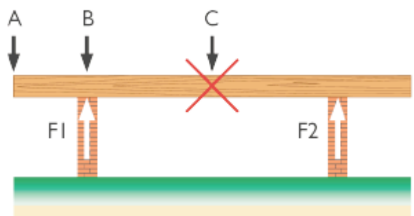
b) The force is equal in magnitude (size) [1] and opposite in direction to that of the force shown [1]. (From Newton's 3rd law.)

c) clockwise moments = anticlockwise moments [1] so 30 N × 0.8 m = downward force of the block on the short end of the crowbar × 0.05 m [1]. From this (and part b) the upward force on the block is 480 N [1].

17. a) The stability of the bus depends on its wheelbase (which cannot be altered) and the centre of gravity of the bus + passenger load [1]. Loading the upper deck of the bus raises the centre of gravity to its highest possible point [1]. If the bus can pass the topple test in this unusual condition it will be more stable than this under typical loading conditions [1].

b) The mass of the base should be larger than the mass of the umbrella itself [1]. The concrete base should have a large diameter [1] and a low profile (height [1]. (This is to keep the centre of gravity of the umbrella + base as low as possible and to make the angle to which must be tilted before toppling as large as possible.)

18. a)



b) i) 40 N each.

ii) Total downward force = 80 N + 200 N [1] therefore total upward force exerted on the plank by the pillars is 280 N [1] because the vertical forces must balance [1]. As the boy is sitting above the centre of gravity [1] each pillar provides the same force; 140 N each [1].

c) In position B, taking moments about the left hand pillar:

clockwise moments = anticlockwise moments [1]

weight of plank, 80 N × 0.75 m = F2 × 1.5 m [1]

Hence F2 = 40 N as it is in equilibrium. [1]

In position C anticlockwise moment about the left hand pillar is 100 Nm so > clockwise [1] moment [1]. Plank overbalances to the left and F2 is zero [1].

19. a) Comet. [1]

b) Moon (or natural satellite). [1]

c) Solar system. [1]

d) Galaxy. [1]

e) Star. [1]

20. Objects with *mass* exert a *gravitational* force on each other. It is this force that keeps the planets in orbit around the Sun. This size of this force depends on the *mass* of each object and the *distance* they are apart. This force gets *smaller (larger)* as the *distance* between the two objects *increases (decreases)*. [Total 7: One mark for each correct response.]

21. $v = 2\pi r \div T$; r = (385 000 000 m)/2 [1] T = (27.4 × 24 × 3 600)s [1] Correct substitution into equation [1] with correct answer of v = 1022 m/s. [1]

22. a) v = 3 100 m/s, T, period of orbit = period of Earth's rotation, (24 × 3600) s. [1]

$r = (v \times T) \div (2\pi)$ [1] therefore r = 4.26×10^7 m. [1]

b) Height above Earth = 4.26×10^7 m – 6.4×10^6 m. Answer: 3.62×10^7 m. [1]