Mechanics

Physics

Nudger

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Scalars & Vectors

1. Arrow lengths MUST be ≈ proportional to relative magnitude.

2. Full lines for real vectors. Dotted lines for virtual vectors.

3. When in doubt, centre out EXCEPT when requested or for moments (when should be drawn from true origin).

4. Draw the vector triangle and clearly label.

5. Direction of answer vector must be stated NOT just value of angle given. For example, 'At an angle of 30° to the right of the vertical, acting down' (a clear diagram will help here – see point 5 above).

6. Triangle of forces ONLY applies to three coplanar forces producing NO resultant force or moment (although more than three such forces can be RESOLVED to form a triangle, if possible).

7. Track vector signs carefully (particularly for velocities). If a negative sign is needed for an answer (but might be needed in a later part of a question), put (–) in front of the penultimate, non-rounded value to remind yourself.

8. Describe forces where possible using type-of-on to help understand the problem.

9. Begin. Sentences. With. Capitals. If you don't, examiners will be getting more an more annoyed and take a QWC (Quality of Written Communication) off at the earliest opportunity.

10. Names of units are generally NOT capitalised (as they are frequently named after famous scientists, who reserved the capital for their own name).

11. Use words to describe something when asked to 'state': don't just put symbols (hence, 'joules' when asked to state the unit for energy, NOT just 'J').

12. If asked to tick boxes, tick them, don't put crosses (and vice versa).

13. What is the difference between a resultant and a component vector?

14. What is a free body diagram? [115]

Statics & Dynamics

15. $\Sigma F = ma$ NOT just $F = ma$.

16. Displacement is 'x' NOT 's'.

17. Bodies do NOT just 'move' (insufficient precision): they either remain at constant velocity [NI] OR they accelerate [NII].

18. For a body obeying NI do NOT lazily state that 'all the forces are equal and opposite'. Be specific about which forces precisely are equal in magnitude but opposite to each other in direction.

19. A negative acceleration is NOT NECESSARILY a deceleration. The sign of a vector simply indicates its direction (relative to that which you've chosen in the specific question). GCSE lied to you. Suck it up. Failure to understand this will screw you over many, many times (not least in projectiles, see below).

20. The value of g is 9.81 NOT 9.8 (unless explicitly specified). This is physics mechanics, not maths.

21. A decreasing acceleration is NOT a deceleration.

22. The average acceleration of a body falling through a fluid (such as air) depends upon its average drag-to-mass ratio (see sevens – and remember that mass is the product of density and volume). [Indeed, when discussing a changing quantity generally, don't forget that you can only talk about it easily when discussing its average.]

23. Density is ρ NOT p.

24. Do not confuse force, velocity and acceleration: they are not the same thing, whatever your brain tries to tell you. Check that you haven't said ridiculous things like 'The velocity is equal and opposite to drag', for example.

25. What is wrong with this sentence: 'A body obeys Newton's First Law when the forces on it are in equilibrium'?

26. Why did Galileo (Galilei) roll bodies down an inclined plane when investigating free-fall? [139]

27. Why is it wrong to say 'in free-fall all bodies fall with the same velocity'?

28. What is the difference between lift and upthrust?

29. How does a parachute prevent a skydiver from reaching a terminal, terminal speed (and what do you need to be very careful about describing in this context)?

30. Why is it wrong to say [139] '[Galileo] showed mathematically that all objects are attracted towards the Earth due to a force called gravity'?

31. Why is it sensible to demonstrate free-fall with a small, steel ball-bearing rather than a

plastic bead of the same dimensions? [141]

32. What is the 'triangle of forces'?

33. Why does an astronaut orbiting the Earth in a capsule feel weightless?Ω

Kinematics

34. Check axes and prefixes.

35. Amazingly, 'use the graph' turns out to mean 'use the graph': you must use data obtained from graph in your solution (and show value lines for the extraction, clearly).

36. Describe graph gradient using seven-system: do not rely on your 'common sense': you have none, clearly. Remember that 'zero [gradient]' might need additional explanation [or example, a 'zero acceleration' could either be at rest (if along the x-axis on a v-t graph) OR moving with a constant ±velocity (if ± y-value)].

37. Label graphs if requested (for example, if asked to 'label your graph 'D'' . . . then check you have labelled it).

38. If the curve does not go exactly through a grid junction then you must NOT use the junction value; they've made it miss for a reason.

39. Draw value lines (dotted) and put pull-out axis bubbles for all values extracted. You won't get the marks if you don't.

40. State 'Area between line, the [limits] and the x-axis [ALLX] NOT just 'Area under graph' (and check that you are meant to go down to the x-axis, clearly: if not, it would be ALLY, where 'Y' is the y-axis value).

41. When calculating areas, do NOT force non-geometric shapes into easy mathematical approximations (for example, if the area is not triangular, do NOT use the area of a triangle equation to calculate it (!) – you will need to count squares instead (remember: part is half)).

42. You must state the direction of any changes in physics NOT just say there is a change (for example, say 'velocity increases as time increases' NOT just 'velocity changes with time').

43. Which two (of the four main) types of curved graphs are counterintuitive in terms of describing their gradients?

44. Draw x-t, v-t and a-t graphs for a bouncing ball (from when dropped till the time it hits the ground for fourth bounce). Energy is lost only during contact with floor (i.e. neglect air resistance). Take up as positive.

Projectiles

45. Horizontal motion for a body in free fall (no drag) is NOT accelerated (!). Do NOT use xuvat equations with 'g' as 'a'. Just think before answering. The gravitational field acts vertically NOT horizontally (!!) . . . or do you often find yourself falling sideways?

46. Take up as positive ALWAYS, and hence g is negative. Don't chop and change: it will confuse you. (And remember, taking g as negative does NOT NECESSARILY mean the body is decelerating: see above).

Moments

47. Do NOT confuse the definition of moments with the Principle of Moments: read the question properly.

48. Torque is 'τ' NOT 'T'.

49. What is the definition of a body's 'centre of mass' [121]

50. Why is a bike typically less stable than a sledge of equal mass? [121-2]

Work, Energy & Power

51. Energy is the capacity to do work. So $\Delta E = W$.

52. Power is the RATE at which work is done (or energy transformed).

53. Use WWW when answering written questions (What is the transformation: Where is it occurring: and Why (what is the force involved, for example – see hint sheet). Do NOT just write a load of waffly, vague GCSE rubbish. Hence (for a block losing E_k when sliding across a rough surface): 'Kinetic energy is converted into internal energy in both the block and the surface due to frictional forces between the block and the surface' NOT just 'energy is lost due to friction'.

54. Remember to track vector when using the work done equation (hence if the force and displacement vectors are opposite the work will be negative and the body in question is losing energy (that is to say, work is being done BY it, not ON it).

55. Make sure that you use the correct displacement when calculating work done: they can often be sneaky in diagrams by drawing displacement arrows that don't start and end at the same relative point.

56. Remember that the efficiency equation can use work (or energy) as well as power, but that you can NOT mix the two.

57. What do you need to be careful about when calculating how changes in velocity affect changes in kinetic energy (and, indeed, many other such 'change' calculations).

Momentum

58. What is the most common error in momentum answers?

59. Describe the changes in linear momentum and energy that occur when a pair of stationary ice-skaters push away from each other.

60. Describe the changes in linear momentum and energy that occur when a pair of moving ice-skaters push away from each other.

61. Why are both of these ice-skater situations easier to discuss (in terms of momentum and energy) than that of a rocket accelerating upwards from a launchpad?

62. What must you be careful not to get confused about when discussing impulse questions?

63. In which situation might you need to refer to Newton's Third Law: when discussing the impacted or impacting body?

64. Explain how propellers work in terms of momentum.

65. Explain how jet engines work in terms of momentum.

66. Explain how guns work in terms of momentum and energy.

67. What happens to the momentum of the Earth when you drop a ball?

68. Why does a cricketer 'give' with his hands when he catches a ball?

69. Why are eggs transported in expanded polystyrene boxes?

70. How do crumple zones in cars work?

71. What happens to the momentum of an artillery shell when it explodes in mid-flight?

72. Describe an experiment to demonstrate the Conservation of Linear Momentum.

Materials

73. Remember to write tensile stress (or strain).

74. If using 'Y' for the Young Modulus, it is a good idea to write a small note to the examiner saying 'Taking the Young Modulus as 'Y'' (as most will use it at 'E' and may miss your (equally correct and less error strewn) usage).

75. Make sure that unloading lines that are meant to be parallel to loading lines must be parallel. Do NOT do this by eye: measure using squares or similar to make sure.

76. Use a reasonably sharp HB pencil for graphs and make sure the lines are clear. Do NOT use a thick pencil that makes a mess on the page; examiners hate this.

77. Make sure that your line of best fit (LOBF) is a good one, not just a rough, sloppy effort.

78. You must use a substantial range on the x and y axes when using triangles to calculate gradients (largest possible, in fact).

79. What three properties or a body will affect it's stiffness (or elasticity)? [171]

80. How do you calculate Σk for three spring in series, each with stiffness k.

81. How do you calculate Σk for three spring in parallel, each with stiffness k.