Physics

Instructions

Individual, exam-style questions

The questions contained in this booklet match the style of questions that are typically asked in exams. This booklet is not however, a practice exam. Elevate's research with top students identified that top students do more practice questions than anyone else. They begin the process of testing their knowledge early in the year.

Therefore, we have provided exam-format questions that are sorted by topic so that you can answer them as you learn the information, rather than waiting until the very end of the year to complete exams.

Comments, questions?

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Other information

Every effort has been made to ensure the accuracy of the information expressed in this booklet, but no warranty or fitness is implied. If you'd like to provide any feedback on this booklet, let us know at admin@elevateeducation.com.

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Physics Questions

1. Do astronauts on the International Space Station experience zero gravity? Explain the difference between weightlessness and apparent weightlessness.

2. Craig Lowndes, a V8 Supercar driver accelerates at 35 m/s^2 off the start line. How many g- forces does he experience?

3. At the market, a butcher tells you a certain steaks weight is 1kg. Explain why this is not technically correct.

4. Define the terms Uniform Circular Motion and Centripetal Force.

5. By equating Newton's Law of Gravitation with the expression for Centripetal Force, derive the formula for the time that a satellite takes to orbit a body in terms of M, the mass of the large body, and r, the distance between the satellite and the body.

6. In 1971, Apollo 15 astronaut David Scott dropped a feather and a hammer from the same height whilst on the moon. Both hit the ground at the same time. With reference to Newton's Law of Universal Gravitation, identify why both objects accelerate at the same rate?.

7. Does both the hammer and the feather experience the same force?

8. An alien zooms by on a spaceship at half the speed of light. As he passes, he turns on a spotlight and shines it directly in front of him. At what speed do you see the light moving? At what speed does the alien see the torch light move away from him?

9. State Lenz's law.

10. A magnetic field of strength B is passing through a circular loop as shown below. With reference to Faraday's Law and Lenz's law, explain what will happen to the wire if the magnetic field strength is slowly decreased?
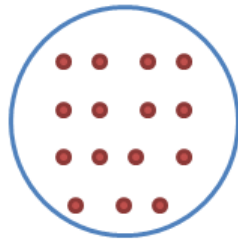
11. With reference to the set-up in question 10, why is Lenz's law really just a consequence of the law of conservation of energy?

12. A loop of wire with area A sits in the presence of a magnetic field of magnitude B. The loop can rotate with constant angular speed ω as shown in the diagram below.
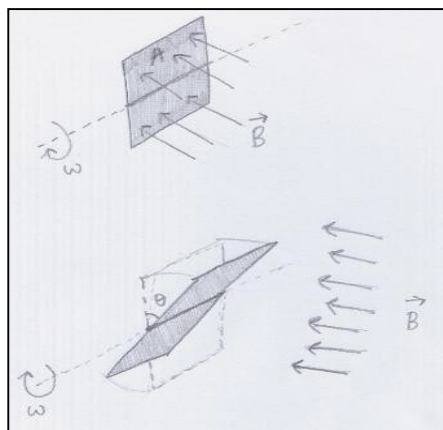
After a time t, the loop makes an angle **θ** with the vertical. What is the magnetic flux that passes when the loop is vertical (**θ** = 0)?

13. What is the magnetic flux that passes through the loop at time t?

14. What is the emf (voltage) induced in the loop at time t? Graph the emf in the loop as a function of time. This question involves differentiation!

15. Is the induced current in the loop AC or DC?

16. Is this an example of a motor or a generator?

17. Define in your own words what the Electric Field is. Draw the electric field emerging from:

    a. a proton
    b. an electron
    c. two charged parallel plates of opposite charge.

18. Explain how a transformer works.

19. Why is a transformer useful in terms of power transmission?

20. Two power lines on a street are 1km long, 80cm apart and carry DC electricity each with a current of 3A. What is the force that one wire exerts on the other? The power is flowing in the same direction.

21. Define the motor effect.

22. A magnet is dropped into a loop of wire and falls out the bottom. Using diagrams to aid your curve, sketch the graph of the induced emf in the loop as a function of time. Explain your graph with reference to both Faraday's Law and Lenz's Law.

23. Justify why the force that a charged particle experiences in a magnetic field qualifies as a centripetal force.

24. Derive an expression for the radius of the circle that the charge particle will travel on.

25. Show that the amount of time it takes for the charge to complete one full revolution is independent of how fast it is moving.

26. Will the see-saw below rotate clockwise, anticlockwise or not at all? Validate your answer with calculations involving torque.
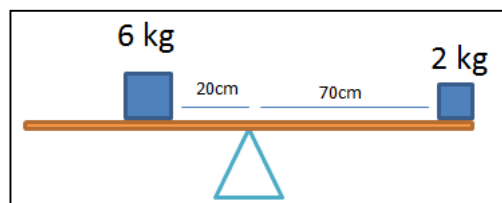
27. A see-saw below is pulled as shown below. Will the see-saw rotate clockwise, anticlockwise or not at all? Validate your answer with calculations involving torque.
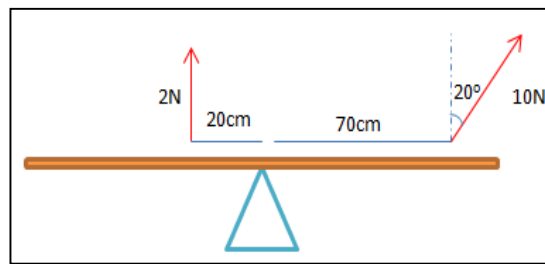
28. Iron filling sit on a flat piece of cardboard. The horizontal cardboard has a wire punched through it which runs vertically (at right angles to the cardboard). What will the iron fillings do when electric current runs through the wire

29. Explain why we denote gravitational potential energy as negative.

30. In the absence of air resistance, a projectile has:

    a. constant horizontal acceleration and constant vertical velocity

    b. constant horizontal velocity and constant vertical acceleration

    c. constant horizontal displacement and constant vertical acceleration

    d. constant horizontal velocity and constant vertical displacement.

31. A tennis ball is launched from sea level at 100m/s at an angle of elevation of 20°. Ignoring air resistance, it will be at a height of 50 metres above sea level

at two different points in time. What are these two points in time?

32. How far horizontally will it have travelled when the ball reaches its maximum height.

33. A hunter is pointing his gun at a monkey in a tree as shown in the diagram below. The gun is pointed at an angle of 30° above horizontal and fires a bullet a 50 m/s. The base of the tree is 200 metres away from the hunter. In order to avoid being shot, the monkey lets go of his branch the moment the gun is fired. How long will it take for the bullet to travel 200 metres horizontally?
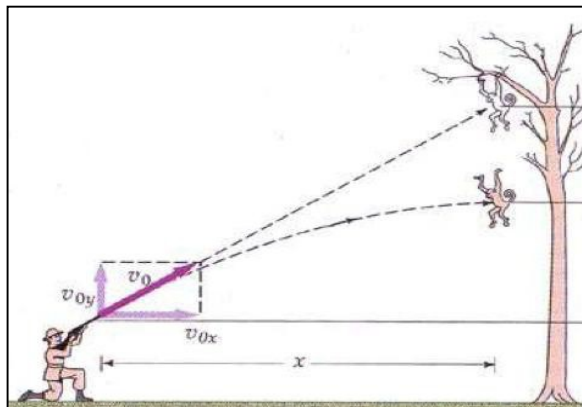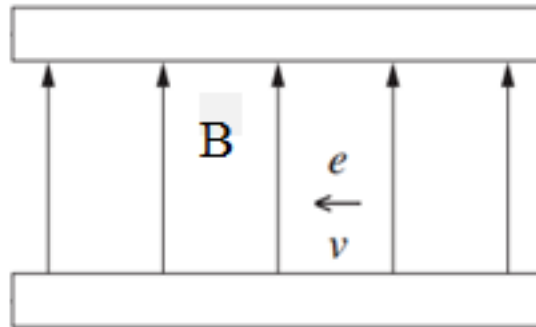

34. How high will the monkey be after that amount of time has passed?

35. How high above the ground will the bullet be after that amount of time?
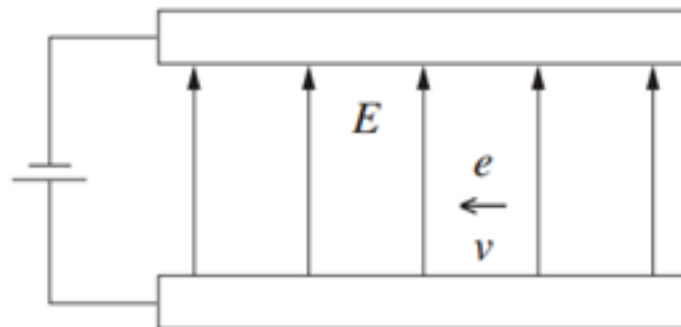
36. Is the monkey doomed whether he lets go or not?

37. In the diagram below, in what direction will the electron experience a force?

38. What is the magnitude of this force given it's moving at 10 m/s in a 2T field?

39. In the diagram below, in what direction will the electron experience a force?

40. Charged particles ejected from the sun get funnelled towards the Earth's north and south pole. Account for why these particles spiral around the Earth's magnetic field lines, as shown below.
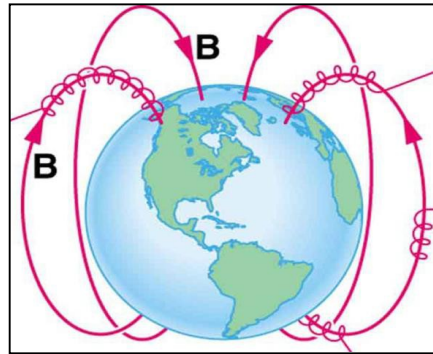
41. Why does the weight of an astronaut change as she moves from the Earth's surface and into outer space?

42. Graph her weight as a function of distance away from the Earth's surface and give a mathematical relation to support your graph.

43. A human can extract 2300 kJ of energy from a Big Mac. How many red photons (of wavelength 700nm) are needed to have more energy than a Big Mac?

44. How much more energy does a blue photon (wavelength 470nm) have than a red photon?

45. Which charge is positive and which charge is negative?
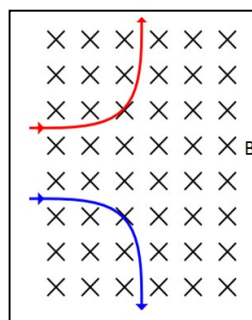
46. Which arms of the aperture below experience a force and in what direction?
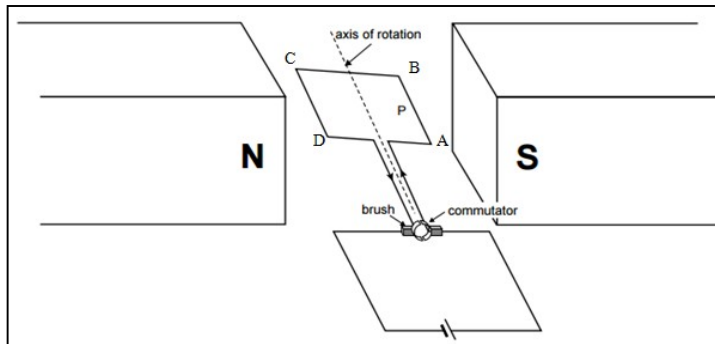
47. If all sides of the above square aperture are 15cm long, the magnetic field is 0.5mT and a 4A current runs through the aperture, what is the output torque of the motor?

48. Outline the difference between election current and conventional current.

49. Assuming the rocket provides constant thrust during take-off, explain why astronauts will experience increasing g-forces as they ascend into outer space.