

Epsom College — 13+ Physics Scholarship 2019

Hearthprep practice paper · 19 questions

1. [3 marks]

The graph shows how the velocity of an aircraft changes as it accelerates along a runway. [Velocity-time graph: x-axis 'time in s' from 0 to 60; y-axis 'velocity in m/s' from 0 to 80. The graph rises approximately linearly from (0,0) to about (30,60) m/s, then curves and levels off near (60,78) m/s.] Use the graph to find the average acceleration of the aircraft.

2. [3 marks]

Explain why the acceleration is not constant, even though the engines produce a constant force.

3. [3 marks]

This question is about electrical components. Draw a straight line from each electrical component to its correct symbol. One has been done for you. [Electrical components listed: ammeter (already matched to the circle containing A), battery, lamp, variable resistor, voltmeter. Symbols listed: long-short pair of vertical lines (two cells, the battery symbol); circle with letter A (ammeter); circle with letter V (voltmeter); rectangle with arrow through it (variable resistor); circle with a cross / X inside (lamp).]

4. [1 mark]

Name an electrical component whose resistance decreases when it is moved into brighter light.

5. [1 mark]

Name an electrical component whose resistance decreases as its temperature increases.

6. [1 mark]

Builders work on a new house. [Image: a partially built house with scaffolding around it; a builder is shown carrying a concrete block.] A builder carries a concrete block from the ground up to the top of the scaffolding. State the equation linking gravitational potential energy, mass, g and height.

7. [2 marks]

The concrete block has a mass of 18 kg. Calculate the gravitational potential energy gained by the concrete block if the scaffolding is 5 m high. (Take $g = 10 \text{ N/kg}$.)

8. [1 mark]

What is the link between the gravitational potential energy gained by the concrete block and the work done by the builder to lift it?

9. [3 marks]

The diagram shows an air track that can be used to investigate motion. Air comes out through a series of small holes in the air track. A small glider floats on a cushion of air. [Diagram: an inclined-looking air track with a glider sitting on it; small holes labelled 'air holes' are visible along the top of the track; a card stands upright on top of the glider; an arrow shows 'air in' at the left.] (i) The diagram below shows the glider at rest on the air track. Complete the diagram to show the forces acting on the glider. Label the forces. One force arrow has been drawn for you. [Diagram: a horizontal section of air track with the glider sitting on top; one upward arrow above the glider has been drawn for the candidate, with a dotted label line.]

10. [2 marks]

Explain what effect the cushion of air has on the movement of the glider.

11. [1 mark]

Two light gates connected to a data logger are placed above the air track so that the card will pass through them. The glider moves at a constant speed to the right. [Diagram: a glider with a card on top moves to the right along an air track, passing first through light gate 1 and then through light gate 2.] The length of the card is 8.3 cm. The card takes 314 ms to pass through the first light gate. State the relationship between average speed, distance moved and time taken.

12. [2 marks]

Calculate the average speed of the card as it passes through the first light gate. (Use length of card = 8.3 cm and time taken = 314 ms.)

13. [1 mark]

State the time taken for the card to pass through the second light gate.

14. [1 mark]

A skydiver jumps from an aircraft. The mass of the skydiver is 70 kg. State the equation linking weight, mass and g .

15. [2 marks]

Calculate the weight of the skydiver and state the unit. (Take $g = 10 \text{ N/kg}$; mass of skydiver = 70 kg.)

16. [4 marks]

The graph shows the vertical velocity of the skydiver during the first 40 s of the fall. His parachute is not open during this time. [Velocity-time graph: y-axis 'Vertical velocity', x-axis 'Time in s' from 0 to 40. The curve rises steeply from the origin, the gradient gradually decreases, and the line levels off at a constant maximum value at about $t = 20\text{--}25 \text{ s}$.] Explain the shape of the graph.

17. [1 mark]

Mains electricity is used in circuits at home. Double insulation is needed for safety when there is: A. no circuit breaker; B. no earth connection; C. no fuse; D. no switch.

- (A) no circuit breaker
- (B) no earth connection
- (C) no fuse
- (D) no switch

18. [1 mark]

A fuse is used so that: A. an earth connection is not needed; B. the appliances are more efficient; C. the circuit cannot overheat if there is a fault; D. the user cannot touch a live wire.

- (A) an earth connection is not needed
- (B) the appliances are more efficient
- (C) the circuit cannot overheat if there is a fault
- (D) the user cannot touch a live wire

19. [1 mark]

Most lamps at home have their own switch. This is because the lamps are connected: A. in parallel; B. in series; C. to a fuse; D. to an earth wire.

- (A) in parallel
- (B) in series
- (C) to a fuse
- (D) to an earth wire