cookie

Practice paper

GCSE Double Award Science Higher, practice paper: Physics Unit P1 (CCEA style)

In the style of CCEA GCSE Science Double Award (2017) Unit P1: Physics, Higher Tier

Practice paper written by cookie in the style of CCEA GCSE Science Double Award (2017) Unit P1: Physics, Higher Tier. Not a CCEA paper; not affiliated with or endorsed by CCEA.

Time allowed: 1 hour

Total marks: 70

Name _____

Instructions

- Answer all nine questions in the spaces provided.
- You may use a scientific calculator.
- Show your working in calculations: you may get marks for a correct method even if your final answer is wrong.
- Give the unit of your answer when you are asked to.
- No equations are given on this paper: you must recall the equations you need.
- Take the gravitational field strength, g, to be 10 N/kg.
- Quality of written communication will be assessed in Question 2.
- This paper covers Unit P1: motion and its graphs; forces, Newton's laws, Hooke's law, pressure and moments; density and kinetic theory; energy, efficiency, work and power; atomic and nuclear physics, including radioactivity, half-life, fission and fusion.

Information

- The marks for each question are shown in brackets at the end of each part.
- The maximum mark for this paper is 70.

Do it online, timed and marked:
cookie.education/past-papers/gcse/cookie/science-double-award-ccea-style

Answer ALL questions. Write your answers in the spaces provided.

1 A student measured the density of a small brass padlock using a eureka (displacement) can. She filled the can with water until water dripped from the spout, waited for the dripping to stop, then lowered the padlock in on a thread and collected the water that overflowed in a measuring cylinder.

(a) Explain why the can was filled until water dripped from the spout before the padlock was lowered in.

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(1)

(b) The volume of water collected was 18.0 cm^3. The mass of the padlock was 151.2 g. Calculate the density of the brass. Include the unit in your answer.

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(4)

(c) At 100 °C, the density of liquid water is about 0.96 g/cm^3 and the density of steam is about 0.0006 g/cm^3. Use kinetic theory to explain why the density of steam is so much less than the density of liquid water.

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(2)

(Total for Question 1 is 7 marks)

2 A student investigates how the average speed of a trolley rolling down a runway depends on the height of the raised end of the runway. Describe how the student should carry out this investigation. Your answer should include: the measurements the student should make and the apparatus used for each; how the student should work out the average speed; how the student should make the results fair and reliable. Your written communication is marked in this question, including how well you use scientific terms.

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(Total for Question 2 is 6 marks)

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3 Nuclear power stations use the fission of uranium-235, $^{235}_{92}U$, to generate electricity.

(a) State the number of protons and the number of neutrons in a nucleus of uranium-235.

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(b) Describe how fission of uranium-235 takes place in a reactor and how it can continue as a chain reaction.

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(c) A nuclear power station does not release carbon dioxide when it generates electricity. Suggest why electricity from nuclear fission still adds some greenhouse gases to the atmosphere.

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(1)

(d) A power station uses 6.0 kg of uranium-235 in fission reactions. Use your knowledge of how the energy released per kilogram of fuel by fusion compares with that released by fission to estimate the mass of hydrogen isotopes that would need to fuse to release the same amount of energy.

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(2)

(Total for Question 3 is 8 marks)

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4 A student investigated how the length of a spring changed as she hung weights from it. The unstretched length of the spring was 6.0 cm. The table shows her results.

Load in N	**0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**
Length of spring in cm	6.0	8.5	11.0	13.5	16.0	18.5	22.4

(a) Calculate the extension of the spring when the load was 4.0 N.

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(1)

(b) Use your answer to (a) to calculate the spring constant of the spring. Include the unit in your answer. Keep the extension in centimetres.

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(c) The student said that the spring obeyed Hooke's law for every load she used. Use the results to explain whether she was correct.

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(Total for Question 4 is 7 marks)

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5 A tram travels in a straight line from one stop to the next. Its velocity–time graph is made of three straight lines joining the points in the table.

Time in s	**0**	**8**	**38**	**48**
Velocity in m/s	0	12	12	0

(a) Calculate the acceleration of the tram during the first 8 seconds. Include the unit in your answer.

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(b) Calculate the displacement of the tram between the two stops.

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(c) Calculate the average velocity of the tram for the whole journey between the stops.

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(Total for Question 5 is 10 marks)

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6 A small hydroelectric power station is built where water from a lake in the hills flows down through pipes to turbines 45 m below.

(a) Explain why hydroelectricity is described as a renewable energy resource.

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(b)

(i) Each second, 80 kg of water falls through the vertical height of 45 m. Calculate the gravitational potential energy lost by this water each second.

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(ii) The electrical output power of the power station is 27 kW. Assume that the gravitational potential energy lost by the water is the total input energy. Calculate the efficiency of the power station. Give your answer as a percentage.

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(c) Give one way in which building this power station could harm the environment.

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(Total for Question 6 is 8 marks)

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7 A gardener lifts the handles of a loaded wheelbarrow so that its legs are just off the ground. The axle of the wheel acts as the pivot. The weight of the wheelbarrow and its load is 600 N. It acts vertically downwards at a horizontal distance of 0.40 m from the axle. The gardener applies a vertical upward force to the handles at a horizontal distance of 1.5 m from the axle.

(a) The weight of the wheelbarrow and its load acts through their centre of gravity. State what is meant by the centre of gravity of an object.

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(1)

(b) Use the Principle of Moments to calculate the upward force the gardener must apply to hold the wheelbarrow in this position.

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(c) The gardener moves the load in the wheelbarrow closer to the wheel. Explain why this makes the wheelbarrow easier to lift.

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(Total for Question 7 is 7 marks)

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8 This question is about radioactive decay.

(a) Strontium-90, $^{90}_{38}Sr$, decays by emitting a beta particle and forms an isotope of yttrium (Y). Write the complete decay equation, showing the mass number and atomic number of every particle.

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(b) A student measured the background count rate in a laboratory as 40 counts per minute. She then measured the count rate from a sample of a different radioactive isotope, X, every 10 minutes. The table shows her measured count rates, which include the background. Use the results to determine the half-life of isotope X. Show your working.

Time in minutes	**0**	**10**	**20**	**30**	**40**	**50**	**60**
Measured count rate in counts per minute	1640	1171	840	606	440	323	240

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(c) Predict the count rate the student would measure at 100 minutes, including the background.

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(Total for Question 8 is 8 marks)

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9 A builder's hoist uses a steel cable to lift a pallet of bricks of mass 250 kg vertically upwards.

(a) Before it is lifted, the pallet rests on flat ground. The base of the pallet has an area of 1.25 m^2. Calculate the pressure the pallet exerts on the ground. Include the unit in your answer.

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(b) The pallet is then lifted at a constant velocity. State the size of the tension in the cable and use Newton's first law to explain your answer.

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(c) Near the top, the pallet slows down uniformly from 0.90 m/s to rest in 1.5 s while still moving upwards. Calculate the tension in the cable while the pallet is slowing down.

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(Total for Question 9 is 9 marks)

END OF QUESTIONS