The GCSE Physics of the Nintendo Switch

1. A Nintendo Switch is powered by a rechargeable battery. Name the energy store in the battery. [1 mark]
2. When the Switch is being used, the battery transfers energy electrically to different parts of the device. Name two useful energy transfers that happen in the Switch. [2 marks]
3. The Switch becomes warm after it has been used for a long time. Name the wasted energy store that increases. [1 mark]
4. Explain why energy is wasted when current flows through the circuits inside the Switch. [2 marks]
5. State the equation that links energy transferred, power and time. [1 mark]
6. A Switch uses 8 W of power while running a simple game. Calculate the energy transferred in 5 minutes. [3 marks]
7. A demanding game makes the Switch use 18 W of power. Calculate the energy transferred in 20 minutes. [3 marks]
8. Explain why a demanding game drains the battery faster than a simple game. [2 marks]
9. A Switch battery stores 60 000 J of energy. A game uses 12 W of power. Calculate how long the battery would last in seconds. [3 marks]
10. Convert your answer to question 9 into minutes. [1 mark]
11. The Switch charger is connected to the UK mains supply. State the potential difference and type of current supplied by the UK mains. [2 marks]
12. The charger changes the mains electricity into a lower potential difference for the Switch. Explain why this is necessary. [2 marks]
13. A circuit inside the Switch has a potential difference of 5 V and a current of 1.6 A. Calculate the power transferred by the circuit. [3 marks]
14. A tiny component inside the Switch has a resistance of 12 Ω and a current of 0.25 A through it. Calculate the potential difference across the component. [3 marks]

15. A vibration motor in a Joy-Con has a potential difference of 3 V across it and a current of 0.5 A through it. Calculate the resistance of the motor. [3 marks]
16. Explain why copper is used for the wires and circuit tracks inside the Switch. [2 marks]
17. Explain why plastic is used for much of the outer casing of the Switch. [2 marks]
18. A fault causes a larger current to flow through part of the circuit. Explain why this could damage the Switch. [3 marks]
19. The Switch screen produces visible light. Which part of the electromagnetic spectrum is used by the screen? [1 mark]
20. The Switch uses Wi-Fi and Bluetooth to transfer information. Name the type of electromagnetic wave used for these wireless signals. [1 mark]
21. Give one reason why electromagnetic waves are useful for wireless communication. [1 mark]
22. The screen is sometimes difficult to see in bright sunlight. Use the idea of reflection to explain why. [2 marks]
23. Light passes from air into the glass screen. Name the wave effect that can happen when light changes speed at a boundary. [1 mark]
24. The Switch speakers produce sound waves. State the type of wave sound is. [1 mark]
25. A game sound becomes higher pitched. State which property of the sound wave has increased. [1 mark]
26. A game sound becomes louder. State which property of the sound wave has increased. [1 mark]
27. A sound from the Switch has a frequency of 800 Hz and a wavelength of 0.425 m. Calculate the speed of the sound wave. [3 marks]
28. Explain why sound from the Switch cannot travel through a vacuum. [2 marks]
29. The Switch uses radio waves to send data to wireless controllers. Explain why this is an example of information being transferred by waves. [2 marks]
30. A loudspeaker inside the Switch contains a coil of wire and a magnet. Explain how the loudspeaker produces sound. [4 marks]

31. A vibration motor in the Joy-Con uses the motor effect. State what happens to a current-carrying wire in a magnetic field. [1 mark]
32. Give two ways to increase the force on a current-carrying wire in a magnetic field. [2 marks]
33. A student says, “The vibration motor works because electricity is turned directly into sound.” Explain why this is not correct. [2 marks]
34. The Joy-Con vibrates more strongly during part of a game. Suggest what may have increased in the motor circuit. [1 mark]
35. Explain why a motor needs a magnetic field and an electric current to produce movement. [2 marks]
36. A player presses a button on the Joy-Con with a force of 2.5 N. The button moves down 0.006 m. Calculate the work done on the button. [3 marks]
37. A spring inside the button is compressed when the button is pressed. Name the energy store that increases. [1 mark]
38. The Switch has a mass of 0.40 kg. Calculate its weight on Earth. Use g = 10 N/kg. [2 marks]
39. The Switch is lifted 1.3 m from the floor to a table. Calculate the increase in gravitational potential energy. Use mass = 0.40 kg and g = 10 N/kg. [3 marks]
40. The Switch falls from a table. Describe the energy transfer as it falls. [2 marks]
41. Just before hitting the floor, the Switch has a speed of 3.5 m/s. Its mass is 0.40 kg. Calculate its momentum. [2 marks]
42. Explain why a Switch with a larger momentum would be harder to stop. [2 marks]
43. A protective case reduces the damage when the Switch hits the floor. Explain how increasing the stopping time reduces the force on the Switch. [3 marks]
44. The Switch is placed in a dock with a wide base. Explain why the wide base makes it more stable. [2 marks]
45. What is meant by the centre of mass of an object? [1 mark]
46. Explain why a tall, narrow stand would be less stable than a wide dock. [2 marks]

47. A finger presses the touchscreen with a force of 1.8 N over an area of 0.0003 m². Calculate the pressure on the screen. [3 marks]
48. The Switch screen is made from glass or plastic materials. Give one useful property of the screen material. [1 mark]
49. Static charge can build up on plastic surfaces. Explain how rubbing two insulating materials can cause static electricity. [3 marks]
50. Explain why static electricity can be dangerous for small electronic components. [2 marks]
51. The Switch contains both conductors and insulators. Explain why both are needed. [3 marks]
52. A student says, “Plastic is used because it stops all energy transfers.” Explain why this statement is not correct. [2 marks]
53. The processor inside the Switch gets hot when running a demanding game. Explain why the processor gets hotter when more current flows through its circuits. [3 marks]
54. Thermal energy is transferred away from the processor by conduction. Describe how conduction transfers energy through solid materials. [2 marks]
55. Explain why metal parts can help transfer thermal energy away from hot components. [2 marks]
56. Warm air around the Switch rises. Name this method of thermal energy transfer. [1 mark]
57. The Switch emits infrared radiation when it is warm. What happens to the amount of infrared radiation emitted as the temperature increases? [1 mark]
58. Explain why blocking ventilation holes could make an electronic device overheat. [3 marks]
59. The Joy-Con contains sensors that detect movement. What is meant by acceleration? [1 mark]
60. A Joy-Con changes velocity from 0 m/s to 4 m/s in 0.8 s. Calculate its acceleration. [3 marks]
61. Give two input devices on a Nintendo Switch. [2 marks]
62. Give two output devices on a Nintendo Switch. [2 marks]
63. The Switch uses digital signals inside its circuits. Give one advantage of digital signals compared with analogue signals. [1 mark]

64. Explain why a Nintendo Switch is not 100% efficient. [2 marks]
65. A student says, “The energy in the battery disappears when the Switch runs out of charge.” Explain why this statement is wrong. [2 marks]
66. Choose one part of the Nintendo Switch and describe two different areas of physics involved in how it works. [4 marks]
67. Explain how a Nintendo Switch uses physics from electricity, waves and forces during gameplay. [6 marks]