PHYSICS · Practice paper

PHYSICS Practice Paper 1

NAME _____

DATE _____

QUESTIONS
30

TOTAL MARKS
91

SUGGESTED TIME
125 minutes

MARK SCHEME
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Instructions

Answer all questions in the spaces provided or on lined paper. Show your working — you can earn marks for your method even if the final answer is wrong. Number each answer clearly.

1. A block of soap rests on a bathroom shelf. The mass of the soap is 200 g and its base measures 8.0 cm by 5.0 cm. [4 marks]

(a) Calculate the area of the base of the soap in m². [1]

(b) Calculate the pressure the soap exerts on the shelf, stating the equation used. [2]

(c) Give the correct SI unit for pressure. [1]

2. A 12 Ω resistor is connected to a 6 V battery. [3 marks]

(a) Calculate the current through the resistor. [2]

(b) State the equation linking current, voltage and resistance. [1]

3. The table below shows the gravitational field strength on the surface of different planets: [4 marks]

Planet	Gravitational field strength (N/kg)
Earth	10
Mars	4
Jupiter	23
Venus	9

(a) Which planet has the strongest gravitational field strength? [1]

(b) A 60 kg object is placed on Mars. Calculate its weight on the surface of Mars. [2]

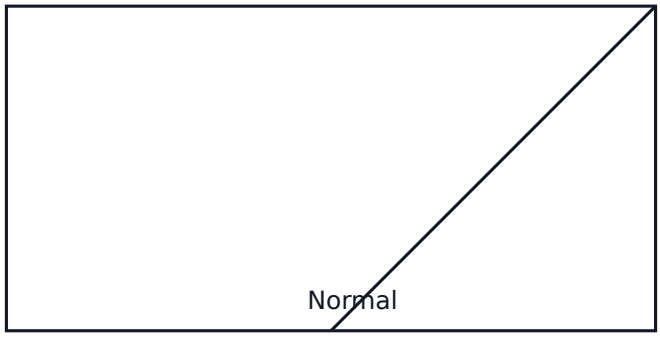
(c) Explain why the weight of an object on Jupiter is more than that on Earth. [1]

4. Both fission and fusion can release a large amount of energy. [4 marks]

(a) State two similarities between nuclear fission and nuclear fusion as sources of energy. [2]

(b) Describe one difference between these two processes. [2]

5. Look at the diagram below showing a ray of light travelling from air into a glass block at 30° to the normal. [4 marks]



Ray of light entering glass at 30° to normal.

(a) State the meaning of 'refraction'. [1]

(b) Draw an arrow on the diagram to show the path of the refracted ray inside the glass block, bending towards the normal. [1]

(c) Explain why the refracted ray bends towards the normal. [2]

6. A student investigates water waves in a ripple tank and observes the behaviour of a ray of light travelling from air into glass. [4 marks]

(a) Describe what is meant by the amplitude and wavelength of a wave. [2]

(b) State what happens to the speed of a ray of light as it passes from air into glass. [1]

(c) Give one unit, other than the metre, used for measuring waves. [1]

7. Name one physical quantity, apart from wavelength, in waves that is measured in metres. [1 mark]

8. Explain what happens when a negatively charged balloon is brought near small pieces of paper. [1 mark]

9. Which statement about infrared radiation is correct? [1 mark]

A Infrared radiation can travel through a vacuum.

B Infrared radiation cannot travel through air.

C Infrared radiation is only present in sunlight.

D Infrared radiation is visible to the human eye.

10. State one disadvantage of burning wood as a fuel. [1 mark]

11. Describe why paint droplets in electrostatic spraying repel each other as they leave the spray gun. [2 marks]

12. The table below shows three planets and their gravitational field strengths: [4 marks]

Planet	Gravitational field strength (N/kg)
Venus	9
Mars	4
Jupiter	23

A spacecraft has a mass of 500 kg.

(a) State the formula for calculating the weight of an object on a planet. [1]

(b) Calculate the weight of the spacecraft on Mars and Jupiter. Give your answers in newtons (N). [2]

(c) Explain why the spacecraft would weigh so much more on Jupiter than on Mars, using ideas about planets and gravity. [1]

13. A large electric motor is used to lift water from a well and also to pump the water through metal pipes. The table shows some of the energy transfers during one second of operation. [5 marks]

Process	Energy transferred (J)
Electrical energy supplied	1800
GPE gained by water	900
Heat energy to pipes	200
Sound energy	10

(a) State the physical quantity which is measured in joules (J). [1]

(b) Calculate the efficiency of the motor in transferring electrical energy to useful energy. Give your answer as a percentage. [2]

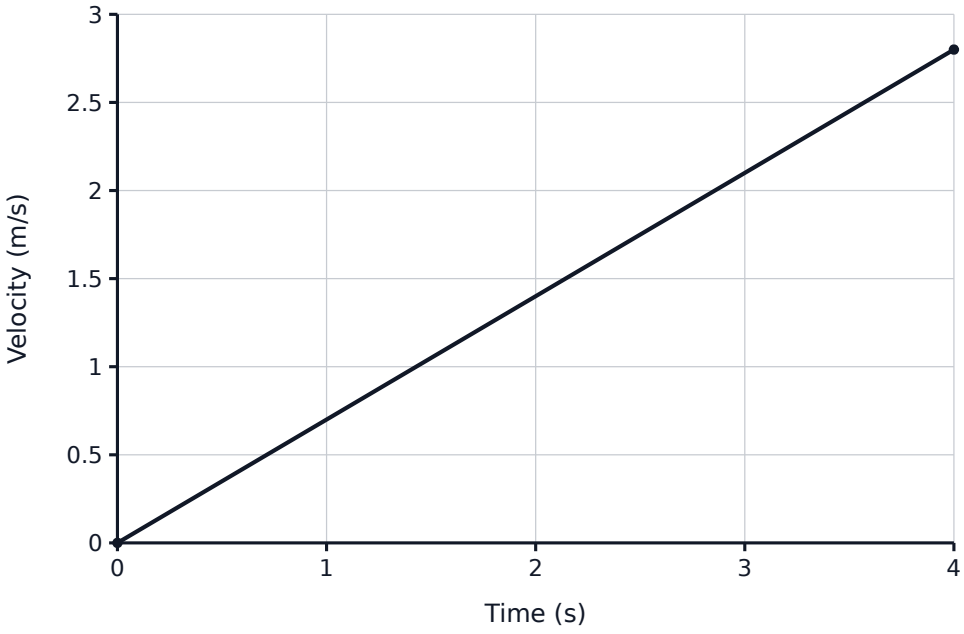
(c) Describe one way that unwanted energy transfer from the pipes could be reduced. [2]

14. A ray of light passes from air into a rectangular glass block at an angle of 38°. Inside the block, the angle of refraction is 24°. [4 marks]

(a) Calculate the refractive index of the glass to 2 decimal places. [2]

(b) Explain what happens to the direction of the light as it enters and leaves the glass block. [2]

15. A trolley of mass 1.5 kg is pulled along a straight track by a constant force. The trolley accelerates from rest to a velocity of 2.8 m/s in 4.0 s. A student draws the velocity–time graph below for the motion: [5 marks]



Velocity–time graph for trolley

(a) Calculate the acceleration of the trolley. [2]

(b) Calculate the resultant (unbalanced) force on the trolley. [2]

(c) State two differences between the information shown on a velocity–time graph and a distance–time graph. [1]

16. A ripple tank is used to study water waves. When the frequency of the motor is increased, the spacing of the wavefronts changes. [5 marks]

(a) Describe, using the terms wavelength and frequency, how the spacing between wavefronts changes as the frequency is increased. [2]

(b) The distance from a crest to the next crest in the tank is measured to be $12\ \text{mm}$. The frequency of vibration is $40\ \text{Hz}$. Calculate the speed of the water waves. Give your answer in m/s. [3]

17. A city is deciding between building a tidal power station and a new gas-fired power station. [5 marks]

(a) Describe the energy transfers that occur in generating electricity using a tidal scheme. [2]

(b) State two disadvantages of tidal power stations. [2]

(c) Explain one reason why a gas-fired power station can quickly respond to sudden demand, but a tidal power station cannot. [1]

18. Which statement best explains why liquids have a much higher density than gases? [1 mark]

A Particles in liquids are much closer together than in gases.

B Particles in liquids are moving faster than in gases.

C Particles in liquids are arranged in a regular pattern.

D Particles in liquids do not move.

19. The diagram below represents simplified stages in the life of a star with a mass much greater than our Sun. [4 marks]



Stages in the lifecycle of a massive star

(a) Describe what happens to the star as it moves from red supergiant (C) to supernova (D). [2]

(b) Explain the main difference between the neutron star and black hole outcomes (E, F). [2]

20. A cyclist travels 200 metres in 25 seconds. [4 marks]

(a) What is the average speed of the cyclist? Give the correct unit and symbol. [3]

(b) Name the SI base unit for time, including its symbol. [1]

21. A student suggests using a transformer with a direct current (d.c.) supply. [2 marks]

(a) Explain why a transformer does not work with d.c. [2]

22. A glass block has a mass of 1.2 kg and a volume of 0.00048 m^3. Calculate the density of the glass. Give your answer to two significant figures and include the correct unit. [3 marks]

23. When a gas is heated at constant pressure, which of the following will increase? [1 mark]

A Its density

B Its volume

C Its mass

D Its pressure

24. A force of 6 N acts on an object for 5 seconds. State the SI unit for each of these two quantities. [2 marks]

(a) Force [1]

(b) Time (duration) [1]

25. Which of the following is the correct SI unit for gravitational field strength? [1 mark]

A N/kg

B kg/m

C m/s

D N·m

26. A racing cyclist travels at an initial speed of 5 m/s and accelerates at 2 m/s² along a straight track. Find the distance the cyclist covers while increasing speed to 17 m/s. Show all your working. [3 marks]

27. A sodium lamp on Earth emits a spectral line with a wavelength of 589 nm. The same line from a distant galaxy is observed at 600 nm. [3 marks]

Calculate the red-shift (z) of light from this galaxy. Use:\n\[z = \frac{\Delta \lambda}{\lambda_0} \] where λ_0 is the original wavelength.

28. Which of the following is NOT a product of uranium-235 fission? [1 mark]

A barium-144

B krypton-89

C proton

D neutron

29. A nuclear reactor uses uranium-235 as a fuel. The uranium-235 nucleus can undergo fission when it absorbs a neutron. The process produces energy, radioactive daughter nuclei, and more neutrons. Control rods and moderators play key roles in the reactor's operation. Some isotopes in the reactor can also emit gamma radiation. [5 marks]

(a) Describe, using nuclear notation if helpful, the basic process of nuclear fission for uranium-235 and why more neutrons are produced in the process. [2]

(b) Explain how a chain reaction is controlled in a nuclear reactor. Your answer should mention the purposes of control rods and the moderator. [2]

(c) One of the fission products emits gamma radiation. Compare the nature and penetration of gamma radiation with that of beta particles. [1]

30. A bungee jumper leaps from a bridge, attached securely to an elastic cord. Describe in detail how energy is transferred between stores from the moment the jumper steps off the platform until the lowest point of the jump, including where energy is not conserved as useful energy. Refer to named energy stores and describe at least three distinct transfers in your answer. [4 marks]

End of paper.

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