

PHY4 REVISION

- A stone of mass 200g on the end of a piece of string of length 80 cm is made to go around a horizontal circle with a speed of 6 m/s. Calculate:
 - the stone's angular velocity;
 - the stone's period;
 - the stone's centripetal acceleration;
 - the centripetal force acting on the stone
- An astronaut of mass 90 kg in the Space Shuttle appears 'weightless'. However, his weight is 850N. Explain the apparent contradiction.
- Using the same time axis, sketch graphs showing how the displacement, velocity and acceleration vary with time for a body undergoing SHM. Your time axis should show two complete periods.
- Define what is meant by SHM.
 - Sketch a graph showing how the acceleration of a body performing SHM varies with displacement.
 - Give one example of an oscillation that is not simple harmonic. Explain why it is not SHM.
- A body of mass 2 kg performing SHM of frequency 50 Hz has an amplitude of 3 cm. Calculate:
 - the period of the oscillation;
 - the maximum speed of the body;
 - the maximum resultant force exerted on the body
 - the displacement of the body from its equilibrium position when its phase has changed by 1 radian from the point it was at maximum displacement.
- Describe how the measurement of the periods of a simple pendulum of varying length can be used to obtain a value of g , the acceleration of free fall.
- A weight of 4N on the end of a vertical spring performs SHM near the Earth's surface. If the equilibrium extension spring is 20 cm, calculate or state:
 - the value of the spring constant;
 - the frequency of the SHM
 - the frequency of the system if it was set up on the surface of the Moon where gravity is one sixth that on the Earth's surface.
- Sketch a graph showing how the amplitude of a driven system varies with the frequency of a driving system.
 - Use your graph to explain what is meant by resonance.
- Define for a progressive transverse mechanical wave: (a) wavelength & (b) amplitude.
- List the main regions of the electromagnetic spectrum starting with the region of greatest:
 - frequency;
 - photon energy
- What regions of the electromagnetic spectrum have the following frequencies or wavelengths in air?
 - 100 m;
 - 3×10^{20} Hz;
 - 5.0×10^{-5} m;
 - 5.0×10^{14} Hz.
- Calculate the respective frequencies and wavelengths of the waves in Q11.
- What is meant by the expression 'plane polarised waveform'?
 - Describe how you would demonstrate that microwaves behave like transverse waves.
- If a radiation obeys the 'inverse square law' what distance change will cause its intensity to increase by a factor of 100?

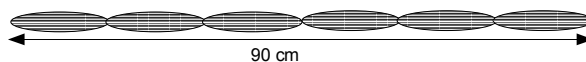
(b) A point light source of power 200W emits energy equally in all directions. Calculate the energy flux of this source at a distance of 40 cm from the source.

15.

- Define what is meant by wave 'superposition'.
- Explain how two light waves might undergo destructive interference.

16. Give four similarities and four differences when comparing stationary and progressive waves.

17. Calculate the wavelength of the stationary wave shown below.



18. What is an antinode? How is one formed?

19. Draw a diagram showing the pattern of wave fronts you would expect to see when plane water waves of frequency 15 Hz and speed 10 cm/s are incident at an aperture of size 3 cm.

20. What is meant by coherence? How can it be achieved using light?

21. In a Young's Slits experiment red light of wavelength 7×10^{-7} m is used to illuminate two slits each of width 0.1 mm and separation 0.4 mm.

(a) Calculate the fringe separation 2 m from the slits.

(b) How would the answer for part change if:

(i) the slit separation was doubled?

(ii) the width of the slits was doubled?

22. How does the photoelectric effect upset the wave theory of light?

23. (a) Calculate the energy of a light photon of wavelength 400 nm.

(b) Calculate the maximum kinetic energy of photoelectrons from a metal of work function 0.5 eV when it is irradiated with the photons of part (a).

24. (a) Calculate the wavelength of light emitted when an electron falls from an energy level of -2.0 eV to one of -25 eV.

(b) In what part of the electromagnetic spectrum is the 'light' emitted?

25. Calculate the wavelength associated with an electron (mass = 9.1×10^{-31} kg) moving at a speed of 4.0×10^7 m/s? [Planck's constant = 6.63×10^{-34} Js]

26. Explain how an absorption spectra is formed.

27. (a) What is the Doppler Effect?

(b) Explain why distant galaxies often show 'Red Shift'

(c) The light from a distance galaxy shows a frequency shift to the red end of the spectrum of 1.5×10^{14} Hz with a spectral line that from the Sun has a frequency of 6.0×10^{14} Hz. How is the distant galaxy moving compared with the Sun?

28. (a) What is Hubble's law?

(b) Express the unit of the Hubble constant in terms of S.I. basic units.

(c) How far away is the galaxy in Q27 in light years?

(d) Explain the connection between this constant and the age of the universe.

29. Explain the difference between the Big Bang & Big Crunch.

30. Sketch a suitable graph to help you explain the difference between an open and closed universe.