PASS PHYSICS P510/1 WITHOUT TEAR

EXPERIMENTS-MECHANICS:

1. To determine acceleration due to gravity using the simple pendulum bob.
2. To determine acceleration due to gravity using a helical spring of known force constant.
3. Determine acceleration due to gravity using a helical spring unknown force constant.
4. Determine centre of gravity of an irregular lamina.
5. To determine relative density of a solid.
6. To determine relative density of a liquid using Archimedes' principle and the principle of moments.
7. To determine the relative density of an irregular solid which floats in water.
8. To determine force constant of a spring.
9. To determine coefficient of limiting / kinetic friction.
10. To determine Young's modulus of a wire.
11. To determine terminal velocity in a liquid.
12. To verify Archimedes' principle.
13. To determine coefficient of viscosity of a liquid using Stoke's law.
14. To determine the universal gravitational constant.
15. To determine coefficient of a liquid using Poiseulli's formula.
16. To measure angle of contact between a liquid and a glass surface.
17. To determine surface tension of a liquid using the capillary tube/microscope slide/ wire frame/ manometer.

EXPERIMENTS-HEAT:

1) To determine specific heat capacity of a solid/ liquid using the electrical method.
2) To determine specific heat capacity of a solid/ liquid using the method of mixtures.
3) To determine specific heat capacity of a solid using the mechanical method.
4) To determine specific heat capacity of a liquid using the method of continuous flow.
5) To determine/ verify cooling correction.
6) To verify Newton's law of cooling.
7) How to measure temperature using the optical (filament disappearing) pyrometer.
8) How to measure temperature using total radiation pyrometer.
9) How to measure temperature using constant-volume gas thermometer.
10) How to measure temperature using an uncalibrated resistance thermometer.

BY KATO IVAN WUUNA
WUNNA EDUCATIONAL SERVICES
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11) To determine/ verify boyle's or charle's laws.
12) To verify that a liquid boils when its saturated vapour pressure is equal to the external pressure.
13) To determine specific latent heat fusion of ice using the method of mixtures.
14) To determine specific latent heat of vaporization using electrical and method of mixtures.
15) To determine saturated vapour pressure of a liquid at various temperatures by the dynamic method.
16) To determine thermal conductivity of a good / poor conductor.
17) To detect thermal radiation using the thermopile / bolometer/ ether thermoscope.
18) To describe how a black body can be approximated.
19) To describe an experiment to compare the energy radiated by two surfaces of different nature.

EXPERIMENTS-MODERN PHYSICS:

1. To describe the main features of CRO.
2. To describe how an ionization chamber works.
3. To describe a simple experiment to demonstrate photoelectric effect.
4. To describe an experiment to show that cathode rays travel in straight line.
5. To explain how an ionization chamber can be used to detect ionizing radiation.
6. To describe the structure and mode of action of a diffusion cloud chamber.
7. To describe with the aid of a labelled diagram, the production of Cathode rays.
8. To describe the structure of the Geiger-Muller tube and how it works.
9. To describe an experiment to determine the stopping potential of a metal surface.
10. To describe the principle of the experiment to determine charge on an oil drop (Millikan's oil drop experiment).
11. To describe an experiment to measure the specific charge of an electron (Thompson's apparatus).
12. To describe the structure of the Geiger-Muller tube and how it works.
13. To draw a well-labelled diagram of the X-ray tube and use it to describe how X-rays are produced.
14. To describe the Bainbridge mass spectrometer and explain how it can be used to distinguish between isotopes/measure specific charges of ions.

EXPLANATIONS-MECHANICS:

1. Explain why a racing car can travel faster on a banked track than on a flat track of the same radius of curvature.
2. Explain and sketch the variation of acceleration due to gravity with distance from the centre of the earth.
3. Explain, with the aid of a sketch graph, what happens to the oscillation a mass attached to one end of a spring clamped vertically if it is immersed in water.
4. Explain why, when catching a fast moving ball, hands are drawn backwards while the ball is being brought to rest.
5. Explain how conservation of energy applies to an object falling from rest in a vacuum.
6. Using molecular theory, explain the origin of solid of friction.
7. Using molecular theory, explain the existence of surface tension on liquid surfaces.
8. Using molecular theory, explain the laws of solid friction.
9. Explain the following terms:

a) Ductility.
b) Stiffness.
c) Brittleness.
d) Elasticity.
e) Malleability.

10. Explain with the aid of a diagram why air-flow over the wings of an aero plane or aircraft at take-off causes a lift.
11. Explain briefly the action of a centrifuge.
12. Explain the energy changes which occur during elastic and plastic deformation.
13. Explain what is meant by banking of a track.
14. Explain why any resistance to the forward motion of an artificial satellite results into an increase in its speed.
15. Explain why acceleration due to gravity varies with location on the surface of the earth.
16. Explain what is meant by term weightlessness.
17. Explain the effect of temperature on the viscosity of a:

a) Gas
b) Liquid

18. Explain what happens when a small steel ball is dropped centrally in a tall jar containing oil.
19. Explain the terms time of flight and range as applied to projectile motion.

20. Explain the effect of increasing temperature of a liquid on its surface tension.
21. Explain the meaning of damped and forced oscillations.
22. Explain why a long jumper normally lands on sand.
23. Explain why the velocity of a liquid at a wide part of a tube is less than that at a narrow part.
24. Explain what happens to the energy used to stretch a wire.
25. Explain why an iron roof makes a cracking sound at night.
26. Explain what is meant by the term simple harmonic motion.
27. Explain why a mass attached to a string rotating at a constant speed in a horizontal circle will fly off at a tangent if the string breaks.
28. Explain why more energy is required to push a wheelbarrow uphill than on a level ground.
29. Explain why a cosmonaut in a satellite which is in a free circular orbit around the earth experiences the sensation of weightlessness even though there is influence of gravitational field of earth.
30. Explain what is meant by laminar and turbulent flow.
31. Explain what is meant by the term Brownian motion.
32. Explain what is meant by the term Projectile motion.
33. Explain what is meant by the term elastic and plastic deformation.
34. Explain what is meant by the term internal energy of a substance.
35. Explain the origin of viscosity in liquids and gases.
36. Explain how a rocket is kept in motion.
37. Explain the energy changes which occur when a pendulum bob is set in to motion.
38. Explain why a person standing near a railway line (highway) is sucked towards the railway line (road) when a fast moving train (trailer) passes.
39. Explain why a passenger in bus (truck) are thrown backwards when the bus (truck) suddenly starts moving.
40. Explain whether a person carrying a bucket of water does any work on the bucket while walking on a level road.
41. Explain what is observed to the period of a simple pendulum bob when it is measured at different locations along a given longitude.
42. Explain why the weight of a body changes when it's moved from the equator towards the poles.
43. Explain why acceleration due to gravity varies linearly with distance from the centre of the earth.
44. Why a large liquid drop resting on a solid surface tends to flatten at the top whereas a smaller drop takes on a spherical shape.

EXPLANATIONS-HEAT:

1. State and explain the sources of inaccuracies in using mercury-in-glass thermometer.
2. Explain what is meant by blackbody and blackbody radiation.
3. Explain how an approximate blackbody can be realized in practice.
4. State and explain the conditions under which real gases behave like ideal gases.
5. Explain why two thermometers may give different values for the same unknown temperatures.
6. Explain three corrections that need to be made when using constant-volume gas thermometer.
7. Explain the extent to which two thermometers based on different thermometric properties but calibrated using the same fixed points are likely to agree when used to measure a temperature.
   a) Near one of the fixed points.
   b) Mid-way between the two fixed points.
8. Explain how cooking at a pressure of 76cmhg and a temperature of 100°C may be achieved at the top of a high mountain.
9. Explain the features of the sketch graphs showing variation of relative intensity of a blackbody radiate with wavelength for three different temperatures.
10. Explain with the aid of a volume versus temperature sketch graph, what happens to a gas cooled at constant pressure from room temperature to zero kelvin.
11. Use kinetic theory of matter to explain the following observations:
    a) Saturated vapour pressure of a liquid increases with temperature.
    b) Saturated vapour pressure is not affected by a decrease in volume at constant temperature.
12. Explain the mechanism of heat transfer in:
    a) Metals (good conductors).
    b) Glass (poor conductors).
13. Explain why when determining the thermal conductivity, the materials are made in the following shapes:
    a) Good conductors are made of longer than their diameter.
    b) Poor conductors are made inform of discs.
14. Explain the signifance of latent heat in regulation of temperature body.
15. Using kinetic theory, explain boiling of a liquid.
16. Explain why latent heat of vaporization is always greater than that of fusion.
17. Explain why a liquid cools when it evaporates.

18. Explain latent heat vaporization of a liquid at 20°C is greater than that at 100°C.
19. With the aid of a P-V diagram, explain what happens when a real gas is compressed at different temperatures.
20. Explain why at a given external pressure, a liquid boils at a constant temperature.
21. With the aid of suitable sketch of graphs, explain the temperature distribution along lagged and unlagged metal rods, heated at one end.
22. Explain why the pressure of a fixed mass of gas in a closed container increases when temperature of the container is raised.
23. Explain the occurrence of land and sea breeze.
24. Explain why substance increases when heated.
25. Explain in terms of specific capacity heat why water is preferred to other liquids for use as a coolant in a car radiator.
26. Explain why the specific latent heat of fusion of a substance is significantly different from its specific latent heat of vaporization at the same pressure.
27. Using kinetic theory the observation that a gas fills any container in which it is placed and exerts a pressure on its walls.
28. Explain why the distinction between specific heat capacity at constant pressure and that at constant volume is important for gases but less important for solids and liquids.
29. Explain why metals are better thermal conductors than non-metallic solids.
30. Explain why temperature of a liquid does not change when the liquid is boiling.
31. Explain the greenhouse effect and how it is related to global warming.
32. Explain the changes that take place in the molecular structure of substances during fusion and vaporization.
33. Explain why molar heat capacity of an ideal gas at constant pressure differs from the molar heat capacity at constant volume.
34. Explain the significance of the terms $\frac{a}{v^2}$ and b in the equation of state for mole of real gas given by $[P+\frac{a}{v^2}]\ [v - b] = RT$.
35. Explain the effect of pressure on boiling point of a liquid.
36. Explain why a metal rod progressively appears dull red, bright red and eventually bluish when heated in a red charcoal stove.

EXPLANATIONS-MODERN PHYSICS

1. Explain two main failures of Rutherford's model of the atom.
2. Explain the mechanism of thermionic emission.
3. Explain using a suitable graphs, how X-ray spectra in an X-ray tube are formed.
4. Explain the mechanisms of photoelectric and thermionic emission.
5. Explain the terms photoelectric emission and thermionic emission.
6. Explain the term stopping potential as applied to photoelectric emission or effect.
7. Explain using quantum theory the experimental observations on photoelectric effect.
8. Sketch the count rate-voltage characteristic of the Geiger-Muller tube and explain its main features.
9. Sketch a graph to show variation of binding energy per nucleon with mass number of elements and explain its features.
10. Explain how Millikan's experiment for measuring the charge of the electron proves that the charge is quantized.
11. Explain the main features of the current-potential difference characteristics of a thermionic diode for two different operating temperatures.
12. Explain the features of the intensity-frequency of a radiation produced in an x-ray tube.
13. Describe the structure of the Bainbridge mass spectrometer and explain how it can be used to distinguish between isotopes.
14. Explain how you would use a decay curve for a radioactive material to determine its half-life.
15. Explain the motion of electrons in a beam when accelerated through a potential difference and directed midway between two oppositely charged horizontal metal plates.
16. Explain how intensity and penetrating power of x-rays from an x-ray tube would be affected by changing the:
    a) Filament current.
    b) High tension potential difference across the tube.
17. Explain what is observed when an electric discharge passes through a gas at pressures varying from atmospheric to about 0.01mmHg as air is pumped out of a discharge tube when the potential difference across the tube is maintained at extra high tension.
18. Explain the purpose of each of the following in a Geiger-Muller tube:
    a) Thin mica window.

b) Argon gas at low pressure.
c) Anode in the form of thin wire.
d) Bead fitted at the free end of the anode wire.
e) Halogen gas (bromine vapour) mixed with argon gas.

19. Explain what is meant by threshold frequency and work function as applied to photoelectric effect.
20. What is a photon?
21. Explain x-ray diffraction by crystals.
22. Explain what is meant by line spectrum.
23. Explain how line spectra accounts for the existence of discrete energy levels in atoms.
24. Explain what is meant by energy level.
25. Explain why a high temperature is required during fusion of nuclides.
26. Use the sketch to show the variation of binding energy per nucleon with mass number to explain how energy is released during nuclear fusion and fission.
27. Explain the following terms as applied to a vacuum diode:
    a) Saturation.
    b) Rectification.
    c) Space charge.
    d) Space charge limitation.
28. Explain the meaning of the following terms as applied to a Geiger-Muller tube:
    a) Dead time.
    b) Quenching agent.
    c) Threshold potential difference.
29. Explain the observations made in the Rutherford's alpha-particle scattering experiment.
30. With the aid of a diagram, explain how an ionization chamber works.
31. Explain why:
    a) Apparatus in Millikan's oil drop experiment is surrounded with a constant temperature enclosure.
    b) Low vapour pressure oil is used in the above mentioned experiment.
32. Explain how x-rays are produced in an x-ray tube.
33. Sketch the ionization current-applied potential difference curve for an ionization chamber and explain its main features.
34. Explain the term avalanche as applied to an ionization chamber.
35. Explain briefly how positive rays are produced.
36. Explain why energies for different energy levels are negative?

37. Explain briefly how cathode rays are produced in a cathode ray tube.
38. Explain why a vacuum is necessary in Rutherford's alpha-scattering experiment.
39. Explain what is meant by unified atomic mass unit.
40. Explain the physical processes in an x-ray tube that account for:
    a) Cut-off wavelength.
    b) Characteristic lines.
41. Explain the following observations when a beam of alpha-particle is directed normally to a thin metal foil:
    a) Most of the alpha-particles passed through the foil.
    b) Few alpha-particles were deflected through angles more than 90°C.

SKETCH GRAPHS-MECHANICS:

1. Distance-time graph for a body moving at constant speed.
2. Distance-time graph for a body having non-uniform speed.
3. Displacement-time graph for a body moving at constant velocity.
4. Displacement-time graph for a body moving at constant acceleration.
5. Displacement-time graph for a body thrown vertically-upwards.
6. Speed-time graph for a body thrown vertically-upwards.
7. Speed-time graph for a uniformly accelerated motion.
8. Velocity-time graph for a body thrown vertically upwards.
9. Velocity-displacement graph for a body performing simple harmonic motion.
10. Acceleration-displacement graph for a body performing simple harmonic motion.
11. Displacement-time graph for a body performing simple harmonic motion.
12. Kinetic energy-displacement graph for a body performing simple harmonic motion.
13. Potential energy-displacement graph for a body performing simple harmonic motion.
14. Total energy-displacement graph for a body performing simple harmonic motion.
15. Tensile stress-tensile strain graphs for:
    a) Rubber.
    b) Brittle (glass) material.
    c) Ductile (metal) material.
16. Force-extension graph for a ductile material.
17. Velocity-time graph for a body falling through a viscous fluid.
18. Variation of acceleration due gravity with distance from the centre of the earth.
19. Variation of gravitational field strength with height above the earth's surface.
20. Displacement-time graph for a body undergoing:

a) Free oscillations.
b) Damped oscillations.
c) Under damped oscillations.
d) Critically damped oscillations.

21. Displacement-time graph for a body attached to a helical spring and oscillating in a viscous fluid.
22. Variation of kinetic energy with height above the ground for a projectile.

SKETCH GRAPHS-HEAT:

1. Pressure-volume graph for a real gas at three different temperatures.
2. Pressure-volume graph for an ideal gas at three different temperatures.
3. Pressure-temperature graph for an ideal gas at constant volume.
4. Volume-temperature graph for an ideal gas at constant pressure.
5. Variation of relative intensity of blackbody radiation with wavelength at three different temperatures.
6. Saturated vapour pressure-temperature graph for a vapour.
7. A graph showing temperature distribution along a lagged and unlagged metal rod when one end is heated.
8. Using the same axes and starting from the same point, sketch the pressure-volume diagram for a gas that undergoes isothermal and adiabatic expansion and compression.

SKETCH GRAPHS-ATOMIC PHYSICS:

1. Output characteristic of a transistor.
2. Decay curve for a radioactive material.
3. Intensity-frequency graph of x-rays produced in an x-ray tube.
4. Intensity-wavelength graph of x-rays produced in an x-ray tube.
5. Ionization current-applied voltage curve for a Geiger-Muller tube.
6. Binding energy per nucleon-mass number graph for unstable nuclides.
7. Collector-current-collector-emitter voltage characteristic of a junction transistor.
8. Current-potential difference characteristics of a thermionic diode for two different operating temperatures.
9. Anode current-potential difference characteristics of a thermionic diode for two different operating temperatures.

DERIVATIONS-MECHANICS:

1. $F = ma$
2. $V=u + at$
3. $S=ut + ½at^2$
4. $V^2=u^2 + 2as$
5. Laws of conservation of linear momentum, $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$
6. Kinetic energy expression for a satellite.
7. Potential energy expression for a satellite.
8. Total mechanical energy for a satellite.
9. Centripetal acceleration expression, $a = \frac{x^2}{r}$,$x = v^2$.
10. Centripetal force expression, $F = \frac{Mx^2}{r}$,$x= v^2$.
11. An expression for the speed with which a car can negotiate a bend on a banked track without skidding.
12. An expression for the lowest velocity which an object must have at the surface of a planet if it's to escape from the planet assuming the gravitational potential, U at the surface of the planet of mass, M and radius, r is given by $U= -GM/r$.
13. An expression for the mass of the sun if the period and orbital radius of one of its planets are known.
14. The period of a satellite around the earth in terms of acceleration due to gravity on the earth's surface and radius of the earth.
15. Kinetic energy expression of a body performing simple harmonic motion.
16. Potential energy expression of a body performing simple harmonic motion.
17. Total mechanical expression of a body performing simple harmonic motion.
18. Work-energy theorem equation.
19. Kinetic energy expression of a body.
20. Gravitational potential energy of a body at a height, h above the ground.
21. Velocity of a body performing simple harmonic motion in terms of amplitude.
22. Acceleration expression of a body performing simple harmonic motion.
23. Bernoulli's principle equation.
24. Excess pressure inside an air/ liquid bubble expression.
25. Expression for height to which a liquid rises/ depresses in a capillary tube.
26. Expression for radius of the common interface when two bubbles coalesce together.
27. Expression for radius of the resulting bubble when one bubble bursts in to another.

28. Expression for work done to create:
    a) Air bubble.
    b) Liquid drop.
    c) Liquid bubble.
29. Expression for Young's modulus in terms of:
    a) Extension produced, cross sectional area, stretching force and original length.
    b) Coefficient of linear expansivity and temperature change of the material.
30. To show that a car does not overturn if V^2<arg/2h, where V= velocity of the car. r= radius of the circular track, a = distance between the wheels, h = height of the centre of gravity of the car above the ground and g = acceleration due to gravity.
31. Expression for velocity of a body performing simple harmonic motion in terms of amplitude and displacement.
32. Expression for energy per unit volume stored in an elastic material.
33. Expression for elastic potential energy stored in an elastic material.
34. Expression for escape velocity of a rocket fired from earth.
35. Expression for the volume of a liquid flowing through a pipe per unit time in terms of its density and coefficient of viscosity of the liquid.