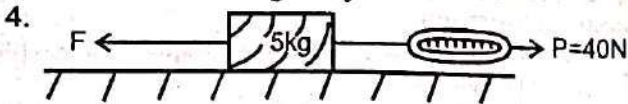


JUNE 2013 WASSCE PHYSICS 2 SECTION A OBJECTIVE TEST

1. The rising of a liquid in an open ended glass tube of narrow bore is A. osmosis. B. adhesion. C. capillarity. D. surface tension.
2. Which of the following units is equivalent to the Watt? A. $kgms^{-2}$ B. kgm^2s^{-3} C. kgm^2s^{-2} D. kgm^2s^{-1}
3. Which of the following statements about pressure in a liquid is **correct**? A. The pressure in a liquid increases with depth B. The higher the density of a liquid, the lower the pressure it exerts C. Pressure in a liquid acts only in a direction perpendicular to the sides of the containing vessel D. Pressure is independent of the acceleration due to gravity.



A block of wood of mass 5kg is pulled on a platform by a force of 40 N as illustrated in the diagram above. If the frictional force, F experienced by the block is 12N, calculate the magnitude of the acceleration of the block. A. $2.4ms^{-2}$ B. $5.6ms^{-2}$ C. $8.0ms^{-2}$ D. $10.4ms^{-2}$

5. Solid friction, like viscosity, is A. independent of the surface areas in contact. B. independent of the relative motion between layers. C. dependent on normal reaction. D. in opposition to motion.
6. The slope of a linear distance-time graph represents A. acceleration B. displacement C. speed. D. velocity
7. A body of mass 2kg is released from rest on a smooth plane inclined at an angle of 60° to the horizontal. Calculate the acceleration of the body down the plane. [$g = 10 ms^{-2}$] A. $3.1ms^{-2}$ B. $5.2ms^{-2}$ C. $6.0ms^{-2}$ D. $8.7ms^{-2}$
8. The total area under a force-velocity graph represents A. energy. B. momentum. C. power. D. pressure.

Use the following information to answer questions 9 and 10. A body of mass 20 g projected vertically upwards in vacuum returns to the point of projection after 1.2s. [$g = 10 ms^{-2}$]

9. Calculate the speed of projection A. $0.6ms^{-1}$ B. $1.2ms^{-1}$ C. $6.0ms^{-1}$ D. $12.0ms^{-1}$
10. Determine the potential energy of the body at the maximum height of its motion. A. 0.36J B. 0.72J C. 360.00J D. 720.00J



Four co-planar forces of magnitudes 10N, 17N, 6N and 20N act at point O as shown in the diagram above. Determine the magnitude of the resultant force. A. 53.0N B. 21.0N C. 7.0N D. 5.0N

12. The maximum displacement on either side of the equilibrium position of an object in simple harmonic motion represents A. period. B. amplitude. C. wavelength. D. frequency.

13. From Newton's first law of motion, A. a body can only undergo translational motion. B. once a body remains at rest no force acts on it. C. the net force acting on a body in uniform linear motion is zero. D. a

body's inertia is its weight.
14. A body of mass 11kg is suspended from a ceiling by an aluminium wire of length 2 m and diameter 2 mm. Calculate the elastic energy stored in the wire. [Young's modulus of aluminium is $7.0 \times 10^{10} Nm^{-2}$; $g = 10 ms^{-2}$; $\pi = 3.14$] A. $1.1 \times 10^{-1} J$ B. $5.5 \times 10^{-2} J$ C. $1.1 \times 10^{-4} J$ D. $5.5 \times 10^{-5} J$

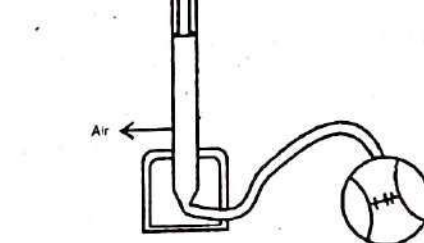
15. The velocity ratio of an inclined plane A. increases with increase in the angle of inclination. B. increases with decrease in the angle of inclination. C. decreases with decrease in the angle of inclination. D. is independent of the angle of inclination.

16. Which of the following types of thermometers is used for the calibration of other thermometers? A. Liquid-in-glass thermometer B. Constant volume gas thermometer C. Optical pyrometer D. thermocouple

17. The magnitude of the expansion or contraction of a substance depends on the I. temperature change. II. nature of the substance. III. size of the substance. Which of the statements above are **correct**? A. I and II only B. II and III only C. I and III only D. I, II and III

18. Highly polished silvery surfaces are A. poor absorbers and poor emitters of radiation. B. good absorbers and good emitters of radiation. C. good absorbers but poor emitters of radiation. D. poor absorbers but good emitters of radiation.

19. The volume of a given mass of gas at $27^\circ C$ and 800 mmHg is $76 cm^3$. Calculate its volume at s.t.p. A. $100.0cm^3$ B. $72.8cm^3$ C. $60.0cm^3$ D. $36.4cm^3$

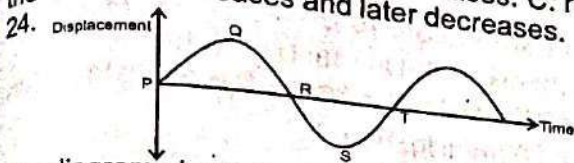


The outlet of a bicycle pump is used to inflate a football as illustrated in the diagram above. Why does the pressure of the air inside the pump increases as the pump handle is slowly pushed downwards at constant temperature? A. Momentum of the air molecules are increased. B. Volume occupied by the molecules are increased. C. Frequency of collision of the air molecules with the walls of the pump is increased. D. More air molecules are colliding with one another in the system.

21. Ice of mass 10g at $-5^\circ C$ was completely converted to water at $0^\circ C$. Calculate the quantity of heat used. [Specific heat capacity of ice = $2.1 Jg^{-1} K^{-1}$; specific latent heat of fusion of ice = $336 Jg^{-1}$] A. 105 J B. 3255 J C. 3465 J D. 16821 J

22. An electric heater has a resistance of 50Ω . When it is immersed in water and connected to mains source, it draws a current of 4.0 A. Calculate the heat gained by the water if the heater is switched on for 2 minutes.

- assuming no heat losses to the surroundings. A. 400J
 B. 1600J C. 24000J D. 96000J
23. When salt is dissolved in water, the freezing point of the water A. increases. B. decreases. C. remains the same. D. increases and later decreases.



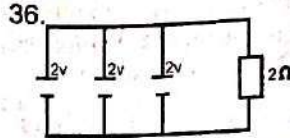
The diagram above illustrates a waveform. Which of the points on the waveform are in phase? A. P and R. B. R and T C. P and T D. Q and S

25. The equation of a certain progressive transverse wave is $y = 2 \sin 2\pi \left(\frac{t}{0.01} - \frac{x}{30} \right)$

where x and y are in cm and t in seconds. Calculate the period of the wave A. 0.001s B. 0.010s C. 10.000s D. 100.000s

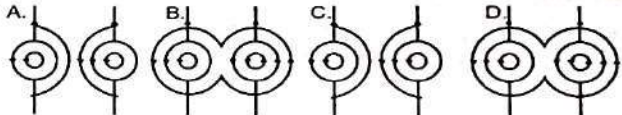
26. At which position should an object be placed in front of a concave mirror in order to obtain an image which is of the same size as the object. A. At the centre of curvature B. At the principal focus C. Between the pole and the principal focus D. Between the centre of curvature and the principal focus.
27. Images formed by a convex mirror are always A. magnified. B. behind the mirror. C. real. D. inverted.
28. The refractive index material is 1.5. Calculate the critical angle at the glass-air interface. A. 19° B. 21° C. 39° D. 42°
29. A diverging lens of focal length 30 cm produces an image 20 cm from the lens. Determine the object distance. A. 10 cm B. 12 cm C. 50 cm D. 60 cm
30. Which of the following statements about the Galilean telescope is **not** correct? A. The final image is inverted. B. It is shorter than terrestrial telescope. C. The final image is erect. D. It has a small field of view.
31. Which of the following radiations has its frequency lower than that of infrared radiation? A. Ultra-violet rays B. Gamma rays C. X-rays D. Radio waves
32. A string under tension produces a note of frequency 14Hz. Determine the frequency when the tension is quadrupled. A. 14Hz B. 18Hz C. 28Hz D. 56Hz
33. Which of the following statements about waves in pipes is **correct**? A. For open pipes, there is only one end correction to be accounted for. B. For closed pipes, there are two end corrections to be accounted for. C. Only odd harmonics are possible in closed pipes. D. All harmonics are possible in closed pipes.
34. When a person holds a negatively charged metal rod and stands bare-footed on the ground, how will the charges leak? A. Negative charges flow to the ground through the person's body B. Positive charges flow from the ground through his body to neutralize the negative charges. C. Positive charges in the air neutralize the negative charges the person is holding. D. Negative charges will leak through the air.
35. A charge of $2.0 \times 10^{-5} C$ experiences a force of 80N in a uniform electric field. Calculate the magnitude of the electric field intensity. A. $8.0 \times 10^6 NC^{-1}$ B. $4.0 \times 10^6 NC^{-1}$

- 1 C. $4.0 \times 10^4 NC^{-1}$ D. $2.0 \times 10^4 NC^{-1}$



- An electric circuit is connected as illustrated above. Determine the equivalent *emf* and current flowing through the circuit respectively, neglecting the internal resistance of the cells. A. 2V, 1.0A B. 2V, 4.0A C. 6V, 0.3A D. 6V, 3.0A
37. A potential difference of 12V is applied across the ends of 6Ω resistor for 10 minutes. Determine the quantity of heat generated. A. 720J B. 1200J C. 14400J D. 43200J

38. A galvanometer of internal resistance of 10Ω has a full scale deflection with a current of 10mA. Calculate the magnitude of the resistance required to convert it to a voltmeter capable of measuring up to 3V. A. 290 Ω B. 300 Ω C. 333 Ω D. 1000 Ω
39. Which of the following instruments is used to determine the accurate value of the electromotive force of a cell? A. Voltmeter B. Meterbridge C. Voltmeter D. Potentiometer.
40. The direction of motion of a current-carrying conductor placed within the opposite poles of a magnet is determined using A. Fleming's left-hand rule. B. Fleming's right-hand rule. C. Maxwell's corkscrew rule. D. Ampere's rule.
41. Two straight current-carrying conductors are placed near each other. Which of the following diagrams **correctly** illustrates the magnetic field pattern formed by the conductors?



42. The capacitance of parallel plates capacitors varies A. inversely as the square of the distance between the plates. B. directly as the square of the distance between the plates. C. inversely as the distance between the plates. D. directly as the distance between the plates.
43. Which of the following devices works on the principle of electromagnetic induction? A. Carbon microphone B. Electric heater C. Moving iron ammeter D. Simple d.c. motor
44. Which of the following devices does **not** make use of eddy current for its action? A. An A. galvanometer. B. speedometer C. induction furnace. D. induction coil.
45. A coil of inductance 0.12H and resistance 4Ω , is connected across a 240V, 50, 50Hz supply. Calculate the current through it. [$\pi = 3.14$] A. 6.3A B. 33.3A C. 37.2A D. 40.0A
46. The work function of a metal is $2.56 \times 10^{-19} J$. Calculate the frequency of a photon whose energy is required to eject from the metal an electron with a kinetic energy of 3.0 eV [$1 eV = 1.6 \times 10^{-19} J$; $h = 6.6 \times 10^{-34} Js$] A. $5.56 \times 10^{19} Hz$ B. $1.66 \times 10^{19} Hz$ C. $1.12 \times 10^{15} Hz$ D. $8.42 \times 10^{14} Hz$
47. The minimum energy required to cause

photoelectric emission when the surface of a metal is irradiated with electromagnetic radiation of suitable frequency is called A. critical energy. B. ionization energy. C. work function. D. Planck's constant.

48. Which of the following particles are termed nucleons in a neutral atom? A. Protons and neutrons B. Neutrons and electrons C. Protons and electrons D. Protons, electrons and neutrons

49. Which of the following statements about the use of radioisotopes is **not** correct? They are used to A. induce mutations in plants and animals to obtain new and improved varieties. B. trace the paths of metabolic processes in plants and animals. C. estimate the age of rocks. D. locate broken bones.

50. Which of the following phenomena supports the theory that waves have a particle nature? A. Electron diffraction B. Photoelectric effect C. Diffraction of light D. X-ray interference.

ANSWERS TO JUNE 2013 WASSCE PHYSICS OBJECTIVE TEST

1. C

2. Power = $\frac{F \times d}{t}$ which can be expressed in unit as

$$\frac{\text{kgm}^2 \times \text{m}}{\text{s}} = \text{kgm}^2 \text{s}^{-2} \times \text{s}^{-1} = \text{kgm}^2 \text{s}^{-3} \quad \text{Ans} = \text{B}$$

3. A

4. From the diagram given in the question, $40\text{N} - 12 = ma$ (the accelerating force)

$$\Rightarrow 28 = 5a \Rightarrow a = \frac{28}{5} = a = 5.6\text{ms}^{-2} \quad \text{Ans} = \text{B}$$

5. D

6. C

Since plane surface is smooth - i.e. neglecting

friction, the force acting on the plane = $2g \sin 60^\circ = ma$

$$\Rightarrow 2 \times \frac{10\sqrt{3}}{2} = 2a \Rightarrow 10\sqrt{3} = 2a \Rightarrow a = \frac{10\sqrt{3}}{2} \approx 8.7\text{ms}^{-2}$$

Ans = D

8. $P = f \times \left(\frac{d}{t}\right) = fv$ Ans = C

9. If the total time spent in air is 1.2s, then the time taken to reach maximum height = $\frac{1.2}{2} = 0.6\text{s}$

$$v = u + gt, 0 = u - 10 \times 0.6 \therefore u = 6\text{ms}^{-1} \quad \text{Ans} = \text{C}$$

10. $20g = 0.02\text{kg}$

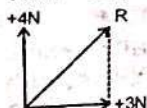
At maximum height, $PE_{\text{max}} = KE_{\text{max}} = \frac{1}{2}mu^2$

$$= \frac{1}{2} \times 0.02 \times 6 \times 6 = 0.36\text{J} \quad \text{Ans} = \text{A}$$

11. From the diagram given in the question:

$$\Sigma F_x = +20\text{N} - 17\text{N} = +3\text{N}$$

$$\Sigma F_y = +10\text{N} - 6\text{N} = +4\text{N}$$



Let R denote the resultant force. Then $R = \sqrt{3^2 + 4^2} = 5\text{N}$ Ans = D

12. B

13. C

14. $F = W = 11 \times 10 = 10\text{N}$, $L = 2\text{m}$,

$$r = \frac{2\text{mm}}{2} = 1\text{mm} = 1 \times 10^{-3}\text{m}$$

$$\text{From } E = \frac{\text{stress}}{\text{strain}} = \frac{FL}{Ae}$$

$$e = \frac{FL}{EA}, A = \pi \times (1 \times 10^{-3})^2 \Rightarrow A = \pi \times 10^{-6}\text{m}^2$$

$$\text{Elastic energy, } PE = \frac{1}{2}Fe = \frac{1}{2}F \times \left(\frac{FL}{EA}\right) = \frac{F^2 L}{2EA}$$

$$= \frac{110 \times 110 \times 2}{2 \times 7 \times 10^{10} \times \pi \times 10^6} = \frac{11 \times 11 \times 10^2}{7 \times \frac{22}{7} \times 10^6} = \frac{11 \times 11 \times 10^2}{22 \times 10^6}$$

Ans = B

$$= \frac{11}{2} \times 10^{-2} = 5.5 \times 10^{-2}\text{J}$$

15. B 16. B 17. D 18. D

19. $P_1 = 800\text{mmHg}$, $V_1 = 76\text{cm}^3$, $T_1 = 27 + 273 = 300\text{K}$

$P_2 = 760\text{mmHg}$, $V_2 = ?$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\Rightarrow V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{800 \times 76 \times 273}{300 \times 760} \approx 72.8\text{cm}^3 \quad \text{Ans} = \text{B}$$

20. C

$$H = mL + mc(\theta_2 - \theta_1)$$

$$H = 10 \times 336 + 10 \times 2.1(0 - -5)$$

$$= 3360 + 10 \times 2.1 \times 5$$

$$= 3360 + 105 = 3465\text{J}$$

Ans = C

22. Heat supplied = heat gained

$$\text{i.e. } I^2 R t = 4^2 \times 50 \times 2 \times 60 = 96000\text{J} \quad \text{Ans} = \text{D}$$

23. B 24. C

$$25. y = 2\sin 2\pi \left(\frac{t}{0.01} - \frac{x}{30}\right) \text{ (given)}$$

$$\Rightarrow y = 2\sin 2\pi \left\{\frac{2\pi t}{0.01} - \frac{2\pi x}{30}\right\}$$

compares with the wave equation,

$$y = A \sin \left\{\frac{2\pi vt}{\lambda} - \frac{2\pi x}{\lambda}\right\}$$

$$\text{to give } \frac{2\pi vt}{\lambda} = \frac{2\pi t}{0.01}$$

$$\Rightarrow f = \frac{1}{0.01}, \therefore T = \frac{1}{f} = 0.01\text{s}$$

Ans = B

26. A 27. C

$$28. n = \frac{1}{\sin C} \Rightarrow \sin C = \frac{1}{1.5}$$

$$\therefore C = \sin^{-1}(0.6667) \approx 41.8^\circ \approx 42^\circ$$

Ans D

29. $v = -20\text{cm}$, $f = -30\text{cm}$

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}, \frac{1}{u} - \frac{1}{20} = -\frac{1}{30}$$

$$\Rightarrow \frac{1}{u} = -\frac{1}{30} + \frac{1}{20} = \frac{-2+3}{60}$$

$$\Rightarrow \frac{1}{u} = \frac{1}{60}, \therefore u = 60\text{cm}$$

Ans = D

30. A 31. D

$$32. f \propto \sqrt{T} \Rightarrow \frac{f}{\sqrt{T}} = \frac{f_2}{\sqrt{T_2}}$$

$$\Rightarrow \frac{14}{\sqrt{T}} = \frac{f_2}{\sqrt{4T}}, f_2 = \frac{14\sqrt{4T}}{\sqrt{T}}$$

$$\therefore f_2 = \frac{14 \times 2\sqrt{T}}{\sqrt{T}} = 28\text{Hz}$$

Ans = C

33. C 34. B

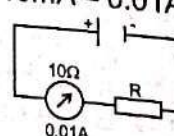
$$35. E = \frac{F}{Q} = \frac{80}{2 \times 10^{-8}} = \frac{8 \times 10 \times 10^8}{2} = 4 \times 10^8 \text{NC}^{-1} \quad \text{Ans} = \text{B}$$

36. Net e.m.f. 2.0v

$$V = IR \Rightarrow I = \frac{V}{R} = \frac{2.0}{2} = 1.0\text{A} \quad \text{Ans: } 2.0\text{v}, 1.0\text{A} \quad \text{Ans} = \text{A}$$

$$37. H = \frac{V^2}{R} t = \frac{12 \times 12}{6} \times 10 \times 60 = 14400\text{J} \quad \text{Ans} = \text{C}$$

38. $10\text{mA} = 0.01\text{A}$



From the diagram, $3\text{v} = 0.01 \times 10 + 0.01 \times R$
 $\Rightarrow 3\text{v} = 0.1 + 0.01R$
 $3 - 0.1 = 0.01R$

$\Rightarrow 2.9 = 0.01R \quad R = \frac{2.9}{0.01} = 290\Omega \quad \text{Ans} = A$

39. D 40. A 41. C

42. From $C = \frac{\epsilon_0 A}{d}$, $C \propto \frac{1}{d}$ Ans = C 43. D 44. D

45. $X_L = 2\pi fL = 2\pi \times 50 \times 0.12 = 100\pi \times 0.12 = 12\pi$
 $\approx 37.71\Omega \quad \therefore Z = \sqrt{4^2 + (37.71)^2} \approx 37.9\Omega$

From $V = IZ$, current, $I = \frac{V}{Z} = \frac{240}{37.9} \approx 6.3A \quad \text{Ans} = A$

JUNE 2013 WASSCE PHYSICS 2 THEORY QUESTIONS

1. A projectile is released with a speed u at an angle θ to the horizontal. With the aid of a diagram, show that the time of flight is equal to $\frac{2u \sin \theta}{g}$, where g is the acceleration of free fall.

2. The horizontal component of the initial speed of a particle projected at 30° to the horizontal is 50 ms^{-1} . If the acceleration of free fall due to gravity is 10 ms^{-2} , determine its:

- (a) initial speed;
- (b) speed at the maximum height reached.

3. In an electrolysis experiment, the ammeter records a steady current of 1 A. The mass of copper deposited in 30 minutes is 0.66 g. Calculate the error in the ammeter reading. [Electrochemical equivalent of copper = 0.00033 g C^{-1}]

4. (a) What is *Brownian motion*?

(b) State the **two** inferences that can be drawn from Brownian motion experiment.

5. A mass of 11.0 kg is suspended from a rigid support by an aluminium wire of length 2.0 m, diameter 2.0 mm and Young's modulus $7.0 \times 10^{11} \text{ Nm}^{-2}$. Determine the extension produced [$g = 10 \text{ ms}^{-2}$; $\pi = 3.142$]

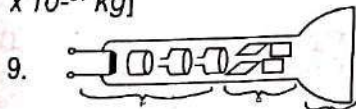
6. (a) What is a *polarizer*?

(b) With the aid of a diagram, explain how a polarizer can be used to polarize a beam of unpolarized light.

7. Name **one** use of '**LASER**' in each of the following areas:

- (a) communication;
- (b) medicine;
- (c) security.

8. The accelerating potential in a cathode ray oscilloscope is 2.5 kV. Calculate the maximum speed of the accelerated electrons. [$e = 1.6 \times 10^{-19} \text{ C}$; $m_e = 9.1 \times 10^{-31} \text{ kg}$]



9. Name the **three** basic components **P**, **Q** and make up a cathode ray tube, as illustrated in the diagram above.

10. Write down the name of:

- (a) **two** particles used in explaining the wave nature of matter;
- (b) **one** device whose invention is based on the wave nature of matter.

11. (a) State the *triangle law of vector addition*.

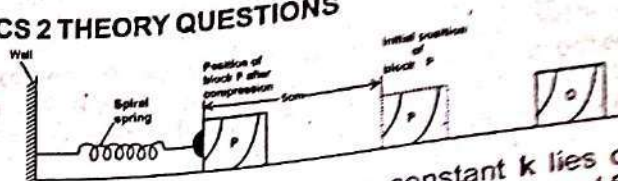
(b) Name the **four** physical quantities that are associated with the equations of linear motion.

(c) Using the same set of axes; sketch and label **two** graphs to illustrate the variation of potential energy and kinetic energy with time for a body in simple harmonic motion.

46. $KE = hf - hf_0 \Rightarrow hf = KE + hf_0$
 $\therefore hf = 3 \times 1.6 \times 10^{-19} + 2.56 \times 10^{-19}$
 $= 10^{-19}(4.8 + 2.56)$
 $= 7.36 \times 10^{-19} \text{ J}$

$\therefore f = \frac{7.36 \times 10^{-19}}{6.6 \times 10^{-34}}$
 $\approx 1.115 \times 10^{15} \text{ Hz} \approx 1.12 \times 10^{15} \text{ Hz} \quad \text{Ans} = C$

47. C 48. A 49. D 50. B



A light spiral spring of force constant k lies on a horizontal frictionless surface and has one end fixed to a vertical wall. A block **P** of mass 2.0 kg placed against the free end of the spring is pushed a distance 5 cm towards the wall with 10 J of energy as illustrated in the diagram above. The block is released and after 0.25s, it collides inelastically with a stationary block **Q** of mass 4.0 kg. Calculate the:

- (i) value of k ;
- (ii) force used to compress the spring;
- (iii) acceleration of the block **P** after release;
- (iv) common speed after collision of the blocks.

12. (a) Define *Boiling point of a liquid*

(b) Describe how water in a round bottom flask could be made to boil without heating it. (**Diagram not necessary**)

(c) State **three** applications of expansion of metals.

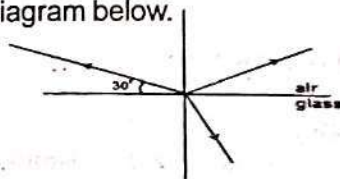
(d) A room with floor measurements $7\text{m} \times 10\text{m}$ contains air of mass 250 kg at a temperature of 34°C . The air is cooled until the temperature falls to 24°C . Calculate the:

- (i) height of the room;
- (ii) quantity of energy extracted to cool the room;
- (iii) Which is higher: the calculated value or the actual energy needed to cool the room? Give a reason for your

13. (a) On which day would sound wave travels faster: on a hot or cold day? Explain.

(b) Why are megaphones shaped like funnels?

(c) A ray of light is incident on a surface of a rectangular glass prism of refractive index 1.5 as illustrated in the diagram below.



(i) Copy the diagram and label the angles of:

- (X) incidence (x);
- (B) reflection (y);
- (Y) refraction (z), with the letters indicated.

(ii) Calculate the angle of refraction to the nearest whole number.

(d) A sonometer wire vibrates in simple harmonic motion with a maximum amplitude of 1.0 cm. Calculate the frequency of vibration of the wire, given that the magnitude of the maximum acceleration of the wire is

$$988 \text{ ms}^{-2} = \frac{22}{7}$$

14.(a) Explain briefly the purpose of earthing an electrical appliance.

(b) Why does the light from a bulb connected to a simple cell dim and eventually goes off after a while?

(c) A coil of inductance 0.007 H , a resistor of resistance 8Ω and a capacitor of capacitance 0.001 F are connected in series to an a.c. source of frequency $\frac{500}{\pi}$ Hz. If the r.m.s. voltages across the coil, the resistor and the capacitor are 30 V , 30 V and 70 V respectively,

(i) draw a vector diagram to illustrate the voltages across the components in the circuit

(ii) Calculate the:

(X) r.m.s voltage of the source;

(B) r.m.s current in the circuit;

(Y) power dissipated in the circuit.

(iii) write down the sinusoidal equation for the r.m.s voltage, V , in terms of the time, t

15.(a) Define ionization potential.

(b)(i) State the three types of emission spectra.

(ii) Name one source each which produces each of the spectra stated in 15 (b)(i). [6marks]

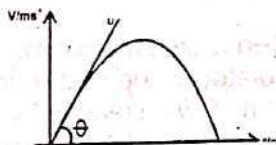
(c) In an x-ray tube, electrons are accelerated to the target by a potential difference of 80 kV . Calculate the:

(i) speed of the electron;

(ii) threshold wavelength of the electron. [$h=6.6 \times 10^{-34} \text{ Js}$; $e=1.6 \times 10^{-19} \text{ C}$; $m_e = 9.1 \times 10^{-31} \text{ kg}$] [4marks]

(d) An x-ray photon of frequency $4.5 \times 10^{18} \text{ Hz}$ strikes an electron, assumed to be at rest. If the electron absorbs all the photon energy, calculate the speed acquired by the electron. [$h=6.6 \times 10^{-34} \text{ Js}$; $m_e = 9.1 \times 10^{-31} \text{ kg}$]

ANSWERS TO JUNE 2013 WASSCE PHYSICS ESSAY QUESTIONS



$u \sin \theta$ if time taken

to reach a height is t then, $v = u \sin \theta - gt$

At maximum height $v = 0$

$$\therefore 0 = u \sin \theta - gt$$

$$t = \frac{u \sin \theta}{g}$$

but the projectile takes the same time to do the rest of the flight (ie trajectory is symmetrical)

$$\therefore \text{Time of flight, } T = 2t = \frac{2u \sin \theta}{g}$$

ALTERNATIVE METHOD

(Magnitude of) vertical displacement $y = (u \sin \theta)t - \frac{1}{2}gt^2$ for time of flight T , (magnitude of) total vertical displacement $y = 0$

$$\therefore 0 = (u \sin \theta)T - \frac{1}{2}gT^2$$

$$T = \frac{2u \sin \theta}{g}$$

2.(a) Let u represent the initial velocity of particle and u_x the horizontal component.

$$u_x = u \cos 30^\circ = 50$$

$$u = \frac{50}{\cos 30}$$

$$= 57.7 \text{ ms}^{-1}$$

(b) Let v represent its velocity at the maximum height. At the maximum height

$$v_y = 0 \quad v_x = u_x = 50 \text{ ms}^{-1}$$

ALTERNATIVELY

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{50^2 + 0^2} = 50 \text{ ms}^{-1}$$

3. Mass deposited, $m = zit$

$$\text{OR} \quad I = \frac{m}{zt} = \frac{0.66}{30 \times 60 \times 33 \times 10^{-3}} = 1.11 \text{ A} \quad \text{Error} = 1.11 - 1 = 0.11 \text{ A}$$

4.(a) Brownian motion

This is continuous random movement of particles suspended in a fluid.

(b) Inferences from Brownian motion

- existence of molecules, (proving the molecular theory of matter)

- motion of molecules, (proving the kinetic theory of matter).

$$5. E = \frac{Ft}{Ae} \quad \text{OR} \quad e = \frac{Ft}{EA}$$

$$= \frac{110 \times 2.0}{7.0 \times 10^{11} \times 3.142 \times \left(\frac{2.0}{1000}\right)^2}$$

$$= 1.0 \times 10^{-4} \text{ m OR } 0.10 \text{ mm}$$

6.(a) A polarizer is an (optical) device which allows vibrations (of light) to pass through in only one plane perpendicular to the direction of propagation.

Note: Accept 'direction' in place of plane.

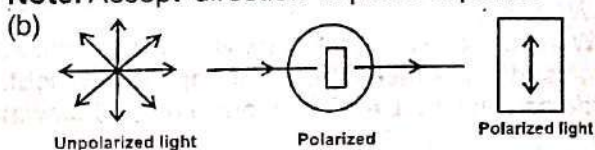


Diagram showing and labeling of all components along with direction of propagation.

Unpolarized light has vibrations in all directions [1/2]. A polarizer blocks all other vibrations [1/2] and transmits vibrations in only one plane perpendicular to the direction of propagation [1/2]

7. Use of LASER

- Communication:- for hologram production, CD, VCD, DVD playing, space communication, data transfer, fiber optic cable.

- Medicine:- welding the retina of our eyes, boring holes in the skull, cervical cancer surgery, dentistry, cauterizing blood vessels, testing biological samples, monitoring glucose level for diabetic patient.

- Security:- guidance system of missiles, aircrafts and satellites, generation of isotopes for nuclear weapons/reactors/enriched uranium production.

$$8. \frac{1}{2}m_e v^2 = eV$$

$$v^2 = \frac{2eV}{m_e}$$

$$= \frac{2 \times 1.6 \times 10^{-19} \times 2500}{9.1 \times 10^{-31}}$$

$$= 8.79 \times 10^{14} \quad v = 2.965 \times 10^7 \text{ ms}^{-1}$$

9. Basic Components of a cathode ray tube