**Answers FOR PHYSICS THEORY**

**QUESTION ONE**

**1. A. i. atoms of the same element with the same proton number but different nucleon                                      number of  neutrons. [1 mark]**

**ii.137 is the sum of protons and neutrons in one atom of the isotope. 55 is the                                     number protons  in one atom of the element. [2 marks]**

**iii.a = 137 b = 56.**

**b. i. Gamma radiation is electromagnetic radiation.**

**ii. Beta radiation consists of electrons. [3 marks]**

**iii.Alpha radiation consists of helium nuclei.**

**c. i. the loss or gain of electrons by an atom to become an ion.**

**ii. Alpha radiation [3 marks]**

**d.Total mass of fragments = 3.418 x 10-25 + 0.066 x 10-25 = 3.484 x 10-25 [1 mark]**

**mass defect = 3.485 x 10-25 – 3.484 x 10-25 = 1 x 10-28 [1 mark]**

**E = mc2  [1 mark]**

**E = 1 x 10-28 x ( 3 x 108)2 = 9 x 1012 J [1 mark]**

**QUESTION TWO**

1. **ΔH = Mc ΔT / Q = Mc ΔT**

**= 0.5 x c x ( 100 -25)**

**= 0.5 x c x 75**

**= 37.5c heat lost by the block. [2 marks]**

**Heat gained by water and container**

**ΔH = Mc ΔT + Mc ΔT**

**0.9 x 4200 x (25-20) + 0.05 X 385 X (25-20)**

**(0.9 X 420 X 5) + (0.05 X 385 X 5)**

**18900 + 96.25**

**18996. 25J [3 marks]**

**Therefore: 37.5c = 18996**

**37.5 37.5**

**C = 18996**

**37.5**

**C = 506.6 J/kg/k or 506.6 Jkg-1K-1 [2 marks]**

1. **i. E = Pt**

**= 16 x 30 x 60**

**= 28.800J [1 mark]**

**Assuming not heat is lost the upper limit for the specific heat capacity of the inner flask and contents would be:**

**C = Pt**

**ΔT**

**C= 28800**

**100 – 20**

**C = 28800**

**80**

**C = 360 J/Kg/K or 360 J Kg-1K-1 [2 marks]**

**ii.E = Pt**

**= 60 x 30 x 60**

**= 108000 J [1 mark]**

**ΔH = P2 t2 - P1t1**

**108000 J – 28800 J**

**79200 J [1 mark] Energy available to vaporize the water.**

**Therefore:**

Mw = 79200

* 1. x106

= 3.5 x 10-2 Kg

= 3.5g [2 marks]

**Total [15 marks]**

**QUESTION THREE**

1. **12V**

**4**

**3**

1. **3A x 2 = 6A**
2. **Q = It**

**= 6 x 6 x 60**

**= 6 x360**

**= 2160C**

1. **E = VIt or Pt**

**= 12 x6 360**

**= 25, 920J**

1. **i. A fuse prevents over-heating in the wiring which may lead to an electric fire should an       excessive large current flows.**

**ii.so that if there is an electrical fault, the fuse breaks resulting in disconnection from the high       and dangerous voltage.**

**iii.Cost = No: of Kw x amount x time in hours.**

**= 0.5 x K1,200 x2**

**= K 1,200**

**iv.E = VIt**

**= 480 x 500 x 120 x 60**

**480**

**= 3,600000 J**

**QUESTION FOUR**

1. **Absolute refractive index is the ratio of the speed of light in a vacuum to the speed of light in a material.**
2. **i. n = Sin i**

**Sin r**

**= Sin 350**

**= Sin 270**

**= 1.26**

**ii.n = Sin i**

**Sin r**

**=Sin 350**

**Sin Q2**

**Sin Q2 = Sin 350**

**1.33**

**Q2 = Sin-1 sin 350**

**1.33**

**= 25.50**

1. **i.**

Correct rays used---1

Images correctly labeled---2

Neatness-----1

ii

Image formed

* Is magnified
* inverted

Screen

Image

**QUESTION FIVE**

**1(a) number of electrons = 50.[2]**

**(b)Number of neutrons = 118 – 550 = 68. [2]**

**© Number of protons = 50. [2]**

**(d) One isotope of this element can have atomic number 0f 50 and mass number 119. [4]**

**2 a is a fast moving electron. [2**

6000

5000

4000

3000

2000

1000

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x |  |  |  |  |  |
| Number of carbon 14 atoms. |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 0 5000 10000 15000 20000 25000 |  |  | x |  |  |

Time (years)

**(b) (i) γrays are neutral/ don’t have charges.**

**(ii)βrays are negatively charged.**

**QUESTION SIX**

**1.a.(i)0.5cm.**

**(ii) 5 cm.**

**(iii)50cm. [3]**

**(b) (i) converging lens. [1]**

**(ii) 28.8cm, 7.5m atleast. [2]**

**(c) (i)deviation is the angle through which any colour is turned from its original path after refraction by a prism.**

**Dispersion is the separation of the colours themselves after refraction through a prism. [2]**

**(ii) primary colours are red,green and blue. The colour complimentary to blue is yellow. This is because the two colours produce white light when they mix. [3]**

**QUESTION SEVEN**

1. **Resolving vectors**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **X cos θ** | **Y sin θ** |  |
| **80N** | **80** | **0** | **[1]** |
| **60N** | **-15.529143** | **57.955595** | **[1]** |
| **40N** | **-28.2842712** | **-28.2842712** | **[1]** |
| **Total:** | **36.18658575** | **29.6712783** | **[3]** |

**Hence,**

29.67

F 2

θ

36.19

**Resultant force FR = 29. 672 + 36.192**

**= 880.3089 + 1309.7161**

**= √ 2190.025**

**= 46. 798N [2]**

**Direction:**

**Tan θ = opp [1]**

**Adj**

**Θ = Tan-1 29.67 [1]**

**36.19**

**Θ = Tan-1 0.81995241289**

**θ =39.350 [2]**

**therefore, the resultant force is 46.798N and the object moves 39.350 from the positive [2]**

**===========================END=================================**

**EIGHT Answers**

1. **The time an event lasts is equal to the number of oscillation. E.g. if an event takes 2 oscillations, time taken is 2 osc.**
2. **(i)**

T

W

(ii**) split W into its components,**

**T = Wy, Wy = Wcos 600; W = m x g**

**M = 600g ; g= 10n/kg**

**W = 0.6 kg x 10N /kg**

**= 6N**

**Therefore, Wy = 6n x cos 600**

**= 6N x 0.5**

**3N**

**Therefore, T = Wy = 3N**

T

Wy

600

Wx

wyyyy

1. **calculate inatatenous force, F = m xa, responsible for swing at point A;**

**Wy balances T; Wx swings bob.**

**Thus, F = Wx = W sinQ = 6N x sin 600 5.2N**

**Making a subject, a= F = 5.2N = 8.67 m/s2**

**M 0.6kg**

1. **Consider that 600 is subtenede by arc; arc length is distance between A and B.**

**S = θ x 2πr**

**360**

**= 600 x 2π x 0.3**

**360**

**= 0.314m**

**= 31.4 cm**

1. **We can consider the pendulum as falling from A to B, and equations q free fall/motion.**

**S = ½gt2**

**T2 = 2s/g**

**= 2 x 0.03 m**

**10m/s2**

**T= √0.006s2**

**= 0.0777s**

**NINE Answers**

1. **i. static friction operates between the surfaces of an object at rest; kinetic friction operates in an object in motion.**

**Ii. When an object just starts moving , the operating force can be reduced to maintain a constant speed.**

1. **force diagram, if static friction is Us**

**Us = Wx, Wx is the weight component that just covered Us**

**Wx = W sin 300**

**Us = W sin 300 ; W = m x g**

**= 2kg x 10N /kg**

**=20N**

**Us = 20N x Sin 300**

**= 20N x 0.5**

**= 10N**

Wy

400

Wx

W

1. **i. the pull of gravity on the block**

**ii W = F x S ; F = Wx; S = 0.5m**

**Wx = Wsin300**

**= 20N x 0.5**

**= 10N**

**W = 10N x 0.5m**

**= 5J**

1. **let kinetic friction be Uk; then Uk = 0.9 Us = ( 1 – 0.1) Us**

**the resultant F, F = Wx – Uk = m x a**

**Us = 10N; Uk = 0.9 x 10N = 9N**

**F = Wx - Uk**

**= 10N – 9N**

**= 1N**

**Therefore, 1N = 2kg x a**

**A= 0.5m/s2**

**But V2 = U2 + 2as**

**U = 0;**

**A= 0.5m/s2**

**S = 0.5m**

**V2 = 02 + 2 x 0.5 x 0.5**

**V2 = 0.50m2/s4**

**V =**

NINE **Solution.**

1. **The energy is called binding energy. [2]**
2. **(i)Fission reaction. Because the nucleus is being split into smaller nuclei.**

**(ii)mass defect = mass of reactants – mass of products.**

**=235.1 u – (148u+85u+1.009u+1.009u)**

**= 235.1u – 235.018u**

**=0.982u**

**(iii)energy = loss in mass**

**Energy = 0.982 u [1]**

**Since 1u = 931eV**

**0.982u = x**

**X = 0.982u x 931 eV**

**X =914.242 eV [1]**

**Energy in J = 914.242 eV x 1.9 x 10-19 J**

**Energy = [2]**

1. **Binding energy = mass of nucleons – mass of nucleus**

**= 4.032u – 4. 0015u**

**= 0.0305u**

**Therefore: energy = 0.0305u x 931 mev**

**Energy = 28.395 mev**

**Energy = 28.4 mev [3]**

1. **A chain reaction is a self perpetuating rapid reaction that occurs during nuclear fission. [2]**

**TEN Answers**

1. **The current needed to deflect the pointer to the end of the scale.**
2. **The resistor is called a shunt. It is connected in parallel, across the terminals of the galvanometer as shown in the digram.**

Shunt

Galvanometer

1. **the resistor is called a multiplier. It is connected in series connection with the galvanometer as shown below.**

Galvanometer

multipier

1. **Using Ohms Law: R= V**

**I**

**In the galvanometer; V = IR**

**= 0.001 x 100**

**= 0. 1v**

**Since the shunt is connected in parallel with the ammeter, the voltage across the shunt is also 0.1 v.**

**since the current that should flow is 5A, and only 0.001 should flow through the ammeter, it means the rest of the current should flow through the shunt.**

**Current through the shunt = 5.000A – 0.001A**

**= 4.999A**

**For the shunt, VI = IR**

**= 4.999 x R**

**= 0.1v**

**R = 0.1**

**4.999**

**= 0.02Ω**

1. **Same current of 0.001A flows through the galvanometer and the multiplier**

**Total resistance = R + 100Ω**

**From Ohms Law; V = IR**

**I = 0.001 x ( R + 100)**

**R = 900Ω**

1. **Capacitance**

**ELEVEN Answers**

1. **The larger Q1 is, the smaller Q3 will be. Therefore, the ray is mostly likely to escape if Q1 = 900**

**So, n1sin Q1 = n2sinQ2 because (1)(1) = n2sinQ2 [1]**

**For the ray to just escape, Q4 = 900, then**

**N2sinQ3 = n1sinQ4 becomes n2sinQ3 = (1)(1) [1]**

**Therefore, we have two conditions to satisfy;**

**n2sinQ2 = 1 and n2sinQ3 = 1**

**their ration gives sin Q2 = 1 [2]**

**sin Q3**

**But we see from the figure that sin Q3 = Cos Q2, and so**

**this becomes tan Q2 = 1 or Q2 = 450**

**then, because n2sinQ2 = 1 , we have**

**n2 = 1**

**sin 450**

**= 1.414 hence, shown. [1]**

1. **i. Expect two internal reflections at sensible angles. [2]**

**ii.Angle of incidence at Y is greater than critical angle**

**Total internal reflection occurs. [2]**

1. **i. F = 1.9 x 108**

**3.2 x 10-7**

**= 5.9 x 1014 Hz [3]**

**ii.Refractive index = 3 or 1.9**

**1.9 3**

**= 1.58**