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| ?# | Difficulty | Skills | Explanations for JUNE 2015 | Answer |
| 1 | 1 | 4, 9 and 29 | Scalar means that direction does not matter. Speed is defined as a scalar and work (like all related energy quantities) is a scalar | 1 |
| 2 | 2 | 15 | GIVENS:vi=9.80 m/sm=3kg | YOU SHOULD KNOW: a=-9.81m/s2vf=0 (high point)mass of a projectile is not relevant | Solution 1:Alternate solution: The path up is the mirror image of the fall from the high point. Falling from zero and reaching a speed of 9.8m/s means 1 second of fall, and 4.9m of height [For a=10m/s2, vf=10m/s, $\overbar{v}$=5m/s and d=5m]Solve for height or dEquation: vf2=vi2+2ad0=(9.8m/s)2 +2 (-9.81m/s2)dd=4.9m  | 2 |
| 3 | 1 | 10 | GIVENS:vx=50m/svy=220m/sv=? | To find the **magnitude** of the resultant for 2 perpendicular vectors use the equation $A=\sqrt{A\_{x}^{ 2}+A\_{y}^{ 2}}$ or write in terms of velocity so $A=\sqrt{(50\frac{m}{s})^{2}+(220\frac{m}{s})^{2}}$= 226m/sNote: The hypotenuse of a right triangle must be bigger than any one side so option 1 and 2 should be eliminated before calculations | 3 |
| 4 | 2 | 20 | YOU SHOULD KNOW: Any object moving at a constant speed is in equilibrium and therefore experiences a net force of zero | 1 |
| 5 | 2 | 20 | YOU SHOULD KNOW: An object in free fall is a projectile which is defined as experiencing a net force of gravity (aka weight (Fg)) of the object. Weight is a downward vector. The weight of the ball is given as 5N  | 3 |
| 6 | 2 | 24 | GIVENS:k=100N/mx= (.65m-0.5m)=.15mFs=? | YOU SHOULD KNOW: For a vertical spring Fs=Fg | Solution: Fs=kx= (100N/m)(0.15m)=15N | 2 |
| 7 | 3 | 27 | GIVENS:m=1.5kgvi=2m/svf=0t=.3sFnet=? | YOU SHOULD KNOW a=Δv/tFnet=maOR mΔv=Δp=J=Fnett | Solution: This requires connecting two equations on the reference table.Option 1:a=Δv/t = $\frac{-2m/s}{0.3s}$=-6.67m/s2Fnet=ma = (1.5kg)(-6.67m/s2)=-10NAsks for magnitude so the negative does not matterOption 2: Use mΔv=Δp=J=Fnett | 3 |
| 8 | 2 | 48, 51, 52 | As a light wave passes from glass into air “index of refraction” (n) decreases so velocity, **wavelength** and angle **increase.** v=fλ and n=c/v so $n=\frac{c}{fλ} $showing an inverse relationship. Remember the frequency of a light wave is fixed as it moves between 2 materials. Amplitude is not included in any equations and has no influence on the other variables on a wave | 4 |
| 9 | 2 | 20 | Newton’s 3rd Law states that when two objects interact the push on each other with equal and opposite force. Since she pushed on the floor with a force of 1000N the floor pushes back with 1000N. Her weight is 500N and this force is not balanced.  | 2 |
| 10 | 2 | 27 | The equation for momentum is p=mv which can be re-arranged as v=$\frac{p}{m}$ which means that “v” is inversely related to “m”. The m is changed from 0.06kg to 0.01kg which means it is divided by 6. So if “m” is divided by 6, “v” is multiplied by 6. So 60m/s x 6 =360m/s Solution 2: set the momentums equal m1v1=m2v2 so (.06kg)(60m/s)=(.01kg)(v2) v2=360m/s | 3 |
| 11 | 2 | 20 and 26 | r=5.6x105mm=1.1x104kgFg=9.1x104kgg=? | Solution: g=$\frac{F\_{g}}{m}=\frac{9.1x10^{4}N}{1.1x10^{4}kg}=8.3N/kg$This equation is used because it asks you to solve for gravitational field strength “g”.The equation Fg=G$\frac{m\_{1}m\_{2}}{r^{2}}$ does not solve for “g” | 3 |
| 12 | 2 | 19 and 35 | The equation the relates electrostatic force (Fe) to distance between centers (r) is Fe=$\frac{kq\_{1}q\_{2}}{r^{2}}$ which shows that Fe and r have and “inverse square” relationship. So if r is x3 , then $\frac{F}{9}$  | 1 |
| 13 | 1 | 40 | GIVENS:V=3VI=1.8x10-4AR=? | R=$\frac{V}{I}=\frac{3V}{1.8x10^{-4}A}=1.67x10^{4}Ω$ | 1 |
| 14 | 1 | ? | Motors are devices that turn electrical energy into mechanical energy | 1 |
| 15 | 2 | 29, 32 | If the total mechanical energy of a system decreases, negative work must be done (ie, work against friction) | 4 |
| 16 | 2 | 37 | GIVENS: V=3VW=? | YOU SHOULD KNOW:The electron is an elementary charge and its charge in coulombs is q=1.6x10-19C on front of PRT | SOLUTIONS: W=Vq = (3V)(1.6x10-19C)=4.8x10-19J | 2 |
| 17 | 2 | 39 | GIVENS:L=6.0mR=1.3ΩA=? | You should know: The resistivity of copper is found on the front of the PRT ρ=1.72 x 10-8Ωm | SOLUTION$$R=\frac{ρL}{A} rearranges to A=\frac{ρL}{R} so$$A=$\frac{(1.72x10^{-8}Ωm)(6m)}{1.3Ω}=7.9x10^{-8}m^{2}$ | 1 |
| 18 | 1 | 38 | q=5Ct=0.05sI=? | I=q/t=5C/0.05s=100A = 1x102A(Remember that if “q” had been given in elementary charge, you would need to convert into coulombs in order to solve for current in amperes  | 4 |
| 19 | 2 | 40 | In a series circuit the potential difference (voltage) is split between each resistor and the current in each is the same To determine the potential difference across each resistor use Ohm’s Law written as V=IR V and R have a direct relationship. So V varies directly with R | 1 |
| 20 | 2 | 48, 49, 50 | The amplitude of a mechanical wave (including sound waves) is related to energy. For sound waves energy is loudness. | 3 |
| 21 | 1 | 48 | Frequency is defined as the number of cycles per second. So 5 cycles/10 seconds =0.5Hz | 2 |
| 22 | 2 | 14 | As a ball falls freely from rest it experience a net force of gravity. If a net force is present acceleration is present. This is represented on a dot diagram as increasing space between dots.  | 2 |
| 23 | 2 | 51 | All forms of EM radiation (light waves) move at 3 x 108 m/s in a vacuum | 3 |
| 24 | 2 | 48 | The equation that relates frequency to wavelength v=fλ which can be rearranged as λ=$\frac{v}{f}$ showing that wavelength and frequency are inverse (speed in the wavelength is fixed). Therefore, if frequency doubles, wavelength is halved.  | 2 |
| 25 | 1 | 49 | Phase is defined as a wavelength or a whole number multiple of a wavelength away. Both particles must have the same motion (ie both move up, both move down etc) | 4 |
| 26 | 1 | 49, 50 | A longitudinal wave is defined as one in which the particles move parallel to the propagation of the energy of the wave  | 1 |
| 27 | 1 | 53 | Resonance is defined as matching the frequency of a medium with a wave frequency from the surroundings | 4 |
| 28 | 1 | 52 | Diffraction is defined as the bending of a wave through and opening or around an obstacle | 4 |
| 29 | 2 | 57 | The energies in eV listed next to any given level is the minimum energy required for an electron to escape (ionize). | 3 |
| 30 | 2 | 35 | GIVENS:q1=-1.6x10-6Cq2=+1.0x10-6Cr=2mFe=? | YOU SHOULD KNOW: The electrostatic constant “k” is listed on the front of the PRT as k=8.99x109N$\frac{m^{2}}{C^{2}}$ | SOLUTION: $$F\_{e}=\frac{kq\_{1}q\_{2}}{r^{2}}$$So Fe=$\frac{(8.99x10^{9}N\frac{m^{2}}{C^{2}})(-1.6x10^{-6}C)(1.0x10^{-6}C)}{(2m)^{2}}$ Fe=3.6x10-3N | 2 |
| 31 | 2 | 33 | When two charged objects come in contact they balance out charge. Add total charge and divide by number of objects -1.6x10-6C +1.0x10-6C=(-0.6x10-6C)/2 = -0.3x10-6C which expressed correctly is -3x10-7C | 1 |
| 32 | 2 | 54 | The car is moving away from A, not moving relative to B, and moving toward C. The apparent frequency decreases as a source gets farther away and increases as a source gets closer.  | 2 |
| 33 | 1 | 20 | This question is asking about inertia which is simply mass. The mass does not change with force or time so the 20kg block always has the most inertia | 4 |
| 34 | 1 | 52, 55 | The law of reflection states that the incident angle is equal distance from the normal line as the reflected ray. So the Ray A is equal distance from normal  | 1 |
| 35 | 1 | 53 | Think of the pulse above as positive and the pulse below as negative. As the two rays superpose they will destructively interfere producing 2  | 2 |
| 36 | 1 | 2 | Option (1) 10-2m means 1 x 10-2m = 1 cm **(2) 100 means 1 x 100m = 1m** (3) 101m means 1x101m or 10m (4) 102 means 1 x 102 = 100m. An automobile tire is on the order of magnitude of 1m  | 2 |
| 37 | 3 | 10 | GIVENSA=v=24 m/sΘ=550 (90-35)vx=? | YOU SHOULD KNOW: The angle used in the equations must be relative to x-axis to the angle given 35o is the complement of angle needed | Eastward is “x” so use vx=vcosΘvx=24m/s(cos55o)vx=13.8m/s | 1 |
| 38 | 1 | 14, 17 | Air resistance works against upward and forward velocity | 4 |
| 39 | 2 | 9 | GIVENS:v=20m/st=2 mins (120s)d=? | Solution: d=vt=(20m/s)(120s)=2400m=2.4x103m | 4 |
| 40 | 2 | 12 | GIVENS: vi=15m/svf=25m/st=4sa= | Solution: vf=vi + at25m/s=15m/s + a(4s)=2.5m/s2 | 1 |
| 41 | 2 | 21 | Equilibrium means all force add to zero. Only in option 4 do the sum of the horizontal and vertical each equal zero | 4 |
| 42 | 1 | 28 | Work is equal to energy. Equations that solve for work or energy include KE =1/2mv2 PE=mgh W=Fd (since F=ma becomes W=mad) E=1/2kx2 W=Vq or E=hf or E=mc2  substituting base units for KE, PE etc gives us kgm2/s2 | 3 |
| 43 | 2 | 19, 28 | Potential energy stored in a spring is PEs , change in spring length from equilibrium position is “x”. The reference equation is PEs=1/2kx2 which reveals a direct square relationship between PEs  and x . Direct square graph is an increasing slope | 1 |
| 44 | 2 | 22,30 | GIVENS: P=4.0x 102Wm=50kgd=8mt=? | YOU SHOULD KNOW: Since the object is being lifted a vertical distance the Work is being done against gravity which =PEPE=mgh | SOLUTION: P=$\frac{W}{t}=\frac{mgh}{t}$4.0x102W=$\frac{(50kg)(9.81\frac{m}{s^{2}})(8m)}{t}$t=9.8s | 2 |
| 45 | 3 | 31 | GIVENSm=**5g**=0.005kgv=5m/sPEs=?NOTE UNIT OF GRAMS=MUST BE IN kg since answers are in joules | YOU SHOULD KNOW: Energy is a conserved quantity and can be transferred between forms. In this problem the KE of the ball at launch = PEs of the toy before launch | SOLUTION: PEs=KE since KE =1/2mv2 the equation can be rearranged as PEs=1/2mv2 = ½(0.005kg)(5m/s)2=.0625J | 3 |
| 46 | 2 | 51 | GIVENS:v=2.04x108m/s | YOU SHOULD KNOW:Speed of light changes based on medium according to index of refraction which a ratio between speed in a medium and speed of light in a vacuum | SOLUTION:$n=\frac{c}{v}$=$\frac{3x10^{8}m/s}{2.04 x 10^{8}m/s}=1.47$ =glycerol (see PRT) | 4 |
| 47 | 2 | 57 | GIVENSλ =4.80x10-7mEphoton=? | YOU SHOULD KNOW: Planck’s constant (h) and speed of light in a vacuum (c) are given on PRT | SOLUTION: E=$\frac{hc}{λ}$=$\frac{(6.63x10^{-34}Js)(3x10^{8}\frac{m}{s})}{(4.8x10^{-7}m)}$=4.14 x 10-19J | 3 |
| 48 | 3 | 29 | Work equals the product of force and distance. Since this is a graph of F x d, work equals the area of the graph. Since the graph has two distinct shapes the area of each should be found and then added. A1+A2A1=(3m)(1x104N) =3x104J A2=(6m)(2x104N)=12x104J so 15x104J=1.5x105J | 3 |
| 49 | 1 | 48 | Wave A shows 1.5 cycles over the same distance that wave be shows 3 cycles. Wave B is half the wavelength of wave A. Wave B has crests and troughs double the height of wave A. Wave B has twice the amplitude  | 2 |
| 50 | 1 | 47 | A proton is made up of up and down quarks and has a charge of +1e so the composition is uud | 1 |
| FOR THE REMAINING QUESTIONS SEE ANSWER KEY PROVIDED ON THE PHYSICS REGENTS EXAM WEBSITE |  |
| 51-2 | 1 | 30 | P=Fv |  |
| 53-4 | 2 | 51 | f=c/λ |  |
| 55-6 | 2 | 58 | E=mc2 |  |
| 57 | 1 | 25 | Velocity is tangent to the circle  |  |
| 58-9 | 1 | 25 | ac$=\frac{v^{2}}{r}$ |  |
| 60 | 2 | 17 | The horizontal motion of a projectile is in equilibrium and therefore the horizontal velocity does not change |  |
| 61-2 | 3 | 17 | YOU SHOULD KNOW: Time is dependent on the vertical axis only. If the initial vertical velocity is 7.5m/s the final vertical velocity is -7.5m/s. Acceleration due to gravity must be defined as negative. Use equation vf=vi+at |  |
| 63 | 2 | 55-56 | You should know that all angles are measured between normal line and ray |  |
| 64-5 | 2 | 56 | n1sinΘ1= n2sinΘ2 |  |
| 66 | 2 | 20 | Weight is Fg Fg=mg |  |
| 67-8 | 2 | 23 | For a moving block use coefficient of kinetic friction in the equation Ff=µFN where FN=Fg on a horizontal (level) surface. |  |
| 69 | 2 | 22 | The action is on the horizontal axis so the sum of the forces is Fnet=Ff +FA where Ff is negative and FA is positive |  |
| 70 | 2 | 22 | Since the net force is positive the acceleration is positive which means the magnitude (size) of the velocity will increase |  |
| 71 | 1 | 36 | Electric field lines point away from positive and toward negative |  |
| 72 | 2 | 34 | An electron with be pulled (forced) upward toward the positive plate |  |
| 73-4 | 2 | 35 | The equation is E=$\frac{F\_{e}}{q}$ You should know – the charge on an electron is the elementary charge (1.6x10-19C) |  |
| 75 | 2 | 35 | The force remains constant between parallel plates – This is the uniform field.  |  |
| 76 | 2 | 57 | Level b (5.74 eV– 3.06eV)=2.68 eV level f  |  |
| 77 | 2 | 37, 57  | Convert to joules by multiplying by 1.6 x 10-19J |  |
| 78-9 | 2 | 57 | E=hf you should know h is found on the PRT |  |
| 80 | 2 | 51 | Visible light or more specifically violet |  |
| 81-2 | 2 | 41, 44 | P=$\frac{V^{2}}{R}$ rearrange to R=$\frac{V^{2}}{P}$  |  |
| 83 | 2 | 44 | YOU SHOULD KNOW: If a parallel component is removed it has no impact on other paths only on the overall circuit. So the power in the 100W bulb would remain the same since the V, I, or R don’t change |  |
| 84 | 3 | 44 | If the 60 W bulb were to burn out the equivalent resistance would increase. The greater the number of paths the lower the resistance in a parallel circuit.  |  |
| 85 | 2 | 43,44 | The equivalent resistance of three bulbs in a series circuit is greater than in a parallel circuit.  |  |
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