BEATS ENGINEERING

INSTITUTE OF ENGINEERING

Model Entrance Exam

(Set-4 Solutions)

Instructions:

There are 100 multiple-choice questions, each having four choices of which only one choice is correct.

Date: 2080/03/09
(June-24)

Duration: 2 hours
Time: 8 AM – 10 AM

<u>Section-A</u> (1 marks)

1) c
2) b
3) a
4) a
5) a
6) b
7) b
8) b
9) a
10) c
11) d
12) d
13) c $NaCl \Leftrightarrow Na^+ + Cl^-$
$H_2O \Leftrightarrow H^+ + OH^-$
On passing electricity, Na^+ and H^+ ions move towards cathode. The discharge potential of H^+ ions is less than Na^+ ions. Thus, hydrogen ions get discharged easily and hydrogen is liberated.
14) d
15) a $n = 3, l = 4 \rightarrow 4f$. In f subshell, there are 7 orbitals and each orbital can accommodate a maximum of two electrons, so maximum no. of electrons in 4f subshell $= 7 \times 2 = 14$
16) c Density $= 1.17 g/cc = 1170\ g/L$
Molarity of solution $= \frac{Density\ in\ g/L}{Molecular\ weight} = \frac{1170}{36.5} = 32.05\ M$
17) d Strong conjugate base has a weakest conjugate acid. Since CH_3COOH is weakest acid among the following, therefore its conjugate base is strong.
18) a The atomic number of the given element $= 2 + 2 + 6 + 2 + 3 = 15$
The atomic number of the element present just below the above element $= 15 + 18 = 33$
19) b $4(+1) + 2x + 6(-2) = 0$
$2x = 8 \Rightarrow x = 4$
20) d $NH_4Cl + NaNO_2 \xrightarrow{heat} NH_4NO_2 + NaCl$
$NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H_2O$
21) a Clark's method is used to remove the temporary hardness of water, in which bicarbonates of magnesium and calcium are reacted with slaked lime $Ca(OH)_2$
22) d Na_2S and NaCN are decomposed on heating with HNO_3 to form H_2S and HCN in gaseous phase otherwise they will give precipitate with $AgNO_3$.
$NaCN + HNO_3 \rightarrow NaNO_3 + HCN\uparrow$
$Na_2S + 2HNO_3 \rightarrow 2NaNO_3 + H_2S$
23) b
24) b Moment of inertia (I) $= Mr^2$
$[I] = [ML^2]$
Moment of force (F) $= ma$
$[F] = [ML^2T^{-2}]$
25) d
26) d The relation $\vec{F} = m\vec{a}$ can only be deduced from Newton's second law, if mass remains constant with time. If mass depends on time, then, this relation cannot be deduced.
27) d The direction of the angular velocity is along the axis of rotation.
28) c At the equator, $g_e = g - R\omega^2$
When $\omega = 0$, $g_e = g$
Hence, the value of acceleration due to gravity at the equator remains same.
29) d When a solid sphere falls in vacuum, no viscous force is acting on the sphere and the sphere falls under gravity, due to which sphere never attains terminal velocity.
30) c Mass and volume of the gas will remain same, so density of gas will also remain same.
31) b Since the gas is compressed adiabatically, $dQ = 0$, $dW = -150\ J$
From first law of thermodynamics,
$dQ = dU + dW$
$dU = -dW = -(-150) = 150\ J$
32) b Tuning fork of 256 Hz will resonate with fork of frequencies $1 \times 256, 2 \times 256, 3 \times 256$, ... i.e., 256, 512, 768, …

Fork of 738 Hz will not resonate.

33) a When a glass rod is rubbed with silk cloth then some of the electrons from the glass rod get transferred to the silk cloth and thus the glass rod gets positive charge and the silk cloth gets negative charge. No new charge is created in the process of rubbing.

34) d The deflection in the moving coil galvanometer is:
$\phi = \left(\frac{NAB}{k}\right) I$

35) a $P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$
When one bulb will fuse out, resistance of the series combination will be reduced. Hence, illumination will increase.

36) b The current will decrease. This is because on inserting an iron core in the solenoid, the magnetic field increases and hence magnetic flux linked with the solenoid increases. As per Lenz's law, the emf induced in the solenoid will oppose this increase, which can be achieved by a decrease in current.

37) c

38) d $\sin C = \frac{1}{\mu}$
Since, μ is maximum for violet color, critical angle C is minimum for violet colour.

39) d

40) b Impurity increases the conductivity.

41) d $\sin^{-1}\left(\frac{5}{x}\right) + \sin^{-1}\left(\frac{12}{13}\right) = \frac{\pi}{2}$
$\sin^{-1}\left(\frac{5}{x}\right) = \frac{\pi}{2} - \sin^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{12}{13}\right)$
$\sin^{-1}\left(\frac{5}{x}\right) = \sin^{-1}\left(\frac{5}{13}\right)$
$x = 13$

42) d By sine formula,
$\frac{a}{\sin A} = \frac{b}{\sin B}$
$\frac{6}{\sin 30^\circ} = \frac{8}{\sin B}$
$\sin B = \frac{4}{6} = \frac{2}{3}$
$B = \sin^{-1}\left(\frac{2}{3}\right) = \sin^{-1} x$
$x = \frac{2}{3}$

43) a Clearly, $1 + \sin x \geq 0$
$\therefore \cos x - \sin x = 1$
It is satisfied by $x = 0, x = 2\pi, x = \frac{3\pi}{2}$
Hence, 3 solutions are possible.

44) d $\vec{a} + \vec{b} - \vec{c} = 0$
$\vec{a} + \vec{b} = \vec{c}$
$\left|\vec{a} + \vec{b}\right|^2 = |\vec{c}|^2$
$a^2 + b^2 + 2ab\cos\theta = c^2$
$1 + 1 + 2(1)(1)\cos\theta = 1$
$\cos\theta = -\frac{1}{2}$
$\theta = \frac{2\pi}{3}$

45) b Sum of roots $= -3$
$-\left(\frac{2a+3}{a+1}\right) = -3$
$2a + 3 = 3a + 3$
$a = 0$
$\therefore$ Product of roots $= \frac{3a+4}{a+1} = 4$

46) a $\sum_{n=0}^{\infty} \frac{x^{2n+1}}{(2n+1)!} = \frac{x}{1!} + \frac{x^3}{3!} + \frac{x^5}{5!} + \cdots = \frac{e^x + e^{-x}}{2} = \sin hx$

47) b $c + e = 2d$
$e = 2d - c$
$e - c = 2d - c - c = 2d - 2c = 2(d - c)$

48) d $\frac{(1+i)^2}{i(2i-1)} = \frac{1+2i+i^2}{i(2i-1)} = \frac{1+2i-1}{i(2i-1)} = \frac{2i}{i(2i-1)} = \frac{2(2i+1)}{(2i)^2-1} = \frac{4i+2}{-5} = -\frac{4}{5}i - \frac{2}{5}$
Hence, imaginary part $= -\frac{4}{5}$

49) a First we write six '+' signs at alternate places i.e., by leaving one place vacant between two successive '+' signs. Now there are 5 places vacant between these signs and there are two places vacant at the ends. If we write 4 '-' signs at these 7 places then two '-' will come together.
Hence, total number of ways = ${}^7C_4 = 35$

50) b For f(x) to be defined, $-1 \le \frac{2x+1}{3} \le 3$
$-3 \le 2x + 1 \le 3$
$-4 \le 2x \le 2$
$-2 \le x \le 1$
$\therefore D_f = [-2, 1]$

51) c As we know, $(A \cup B)^c = A^c \cap B^c$
$\therefore (B \cup A)^c = B^c \cap A^c$
Now, $A \cap (B \cup A)^c = A \cap (B^c \cap A^c) = (A \cap B^c) \cap (A \cap A^c) = (A \cap B^c) \cap \phi = \phi$

52) d $\lim_{x\to 0} x\, logx\ [0 \times \infty] form$
$= \lim_{x\to 0} \frac{logx}{1/x} \quad \left[\frac{\infty}{\infty}\right] form$
$= \lim_{x\to 0} \frac{1/x}{-1/x^2} = 0$

53) c $u = \sin^{-1}(x - y) = \sin^{-1}(x - y) = \sin^{-1}(3t - 4t^3) = 3\sin^{-1} t$
$\frac{du}{dt} = \frac{3}{\sqrt{1-t^2}}$

54) c Since tangent is perpendicular to x-axis:
$\therefore$ It's slope $\frac{dy}{dx} = \infty$
$\frac{dx}{dy} = 0$

55) c $\int_{\pi/6}^{\pi/3} \frac{dx}{\sin 2x} = \int_{\pi/6}^{\pi/3} cosec\ 2x\, dx = \frac{1}{2}[\log|\tan x|]_{\pi/6}^{\pi/3} = \frac{1}{2}\left(\log\sqrt{3} - \log\frac{1}{\sqrt{3}}\right) = \frac{1}{2}\left(\log\sqrt{3} + \log\sqrt{3}\right) = \log\sqrt{3}$

56) a When $x = 1,\ y = 1^2 + 2 \times 1 = 3$
When $x = 3, y = 3^2 + 2 \times 3 = 15$
Slope of line joining these points $= \frac{15-3}{3-1} = 6$

57) a Given circle is $(x - 0)^2 + (y - 2)^2 = 4$
Centre $= (0, 2)$ and radius $= 2$
No portion of circle lies below x-axis.
$\therefore$ Area of circle below x-axis $= 0$

58) b Given $x^2 + 2y = 8x - 7$
$x^2 - 8x = -2y - 7$
$x^2 - 2.x.4 + 4^2 = -2y - 7 + 4^2$
$(x - 4)^2 = -2y + 9$
$(x - 4)^2 = -2\left(y - \frac{9}{2}\right)$
$\therefore$ Vertex $= \left(4, \frac{9}{2}\right)$

59) b

60) a If A, B, C, D be given points, then dr's of AB are : a-0, 1+1, 2-3 i.e., a, 2, -1
dr's of CD are : 1-3, b-0, 3-5 i.e., -2, b, -2
Since they are $\perp$,
$a(-2) + 2(b) + (-1)(-2) = 0$
$a - b = 1$

<u>Section-B</u> (2 marks)

61) b For something to be fundamental, it has to be an essential part of something. In this instance, the fundamental shift means that the rules around shopping have changed significantly; therefore, 'major' is the best option.

62) d In the second paragraph we are told that 'Whilst there were concerns about online trading in the early days, this has obviously declined now and as confidence in the internet grows, so too does online shopping.' This helps us to see that people were less confident about buying goods on the internet initially, but their confidence has now grown thus making option D correct. We do not have direct evidence to support any of the other three statements.

63) a The second paragraph tells us that people are busy and that they have less time to visit the shops. We are also told that shopping online allows consumers to shop when it suits them - hence it is an way to fit more into their busy lives.

64) a Option A is false as the first paragraph tells us about the fundamental shift in shopping patterns in the last three years. Option B is true - 'a trip to the shops is still regarded by many as an enjoyable past-time'. Options C and D are also true - 'consumers can shop when it suits them and can also use price comparison and review websites to ensure they are getting the best deal.

65) b $N_1V_1 = N_2V_2$
(NaOH) (Acid)
$\frac{1}{10} \times 25 = N_2 \times 20$
$N_2 = 0.125$
Strength = Normality × Eq. mass
Eq. mass = $\frac{7.875}{0.125} = 63$

66) d $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$
Molar mass of $CaCO_3$ = 100 g/mol
10 g of 90% pure lime $= \frac{10\ g}{100\ g/mol} \times \frac{90}{100} = 0.09\ moles\ CaCO_3$
0.09 moles of $CaCO_3$ on heating gives 0.09 moles of CO_2
At STP, 1 mole CO_2 = 22.4 L
At STP. 0.09 mole CO_2 = $0.09 \times 22.4 = 2.016\ L$

67) c Millimoles of CH_3COOH = $0.1 \times 10 = 1$
Millimoles of CH_3COONa = $0.1 \times 20 = 2$
$p_H = p_{ka} + \log\frac{[conjugate\ base]}{[acid]} = 4.74 + \log\frac{2}{1} = 4.74 + 0.30 = 5.04$

68) a

Electronic Configuration	Group
$[Ne]3s^2 3p^3$	V
$[Ne]3s^2 3p^2$	IV
$[Ar]3d^{10} 4s^2 4p^3$	V
$[Ne]3s^2 3p^1$	III

Since, ionization energy increases in a period and decreases in a group, $[Ne]3s^2 3p^3$ configuration has the highest ionization energy among the given elements.

69) b More the number of sigma C–H bonds at alpha position, more the number of hyper conjugating structures and more the stability. Hence, structure (b) will be the most stable carbocation.

70) b

71) d $\frac{Wt.of\ Oxygen}{Eq.Wt.of\ Oxygen} = \frac{Wt.of\ Ag}{Eq.Wt.of\ Ag}$
$\frac{16}{8} = \frac{Wt.of\ Ag}{108}$
Wt. of Ag deposited = 21.60 gm

72) c $3 \sin A = 6 \sin B = 2\sqrt{3} \sin C = k$ (say)
$\frac{\sin A}{1/3} = \frac{\sin B}{1/6} = \frac{\sin C}{1/2\sqrt{3}} = k$
$a = \frac{k}{3}, b = \frac{k}{6}, c = \frac{k}{2\sqrt{3}}$
$\cos A = \frac{b^2+c^2-a^2}{2bc} = \frac{\frac{k^2}{36}+\frac{k^2}{12}-\frac{k^2}{9}}{2.\frac{k^2}{18}} = \frac{1+3-4}{4} = 0$
$A = 90^\circ$

73) b Putting $x = 1$
Sum of coefficients in the expansion of $(1 - 3x + 10x^2)^n$ is $(1 - 3 + 10)^n = 8^n = a$
And sum of coefficients in the expansion of $(1 + x^2)^n$ is $(1 + 1)^n = 2^n = b$
$\therefore a = 8^n = (2^n)^3 = b^3$

74) a Let the 3 numbers in GP be a, ar, ar^2.
By given conditions,
a, 2ar, ar^2 are in A.P.
$\frac{a+ar^2}{2} = 2ar$
$1 + r^2 = 4r$
$r^2 - 4r + 1 = 0$
$r = \frac{4\pm\sqrt{16-4}}{2} = 2 \pm \sqrt{3}$

75) d $\Delta = 0$
$\begin{vmatrix} 3 & k & -2 \\ 1 & k & 3 \\ 2 & 3 & 4 \end{vmatrix} = 0$
$(-12k - 6 + 6k) - (-4k + 27 - 4k) = 0$
$k = \frac{33}{2}$

76) b $i + \sqrt{3} = 2\left(\frac{\sqrt{3}}{2} + i.\frac{1}{2}\right) = 2\left(\cos\frac{\pi}{6} + i \sin\frac{\pi}{6}\right)$

77) d $f(x) = 2x$ i.e., $y = 2x$
For every value of x, there is distinct value of y. So, it is one-to-one function.
And, $x = \frac{y}{2}$
But, for every value of y like 3, 5, 7, …, there is no natural number in the domain set so it is not onto function.
Hence, f is one-to-one but not onto.

78) a $\lim_{x\to0}\frac{\tan x-\sin x}{x^3} = \lim_{x\to0}\frac{\sin x(1-\cos x)}{x^3\cos x} = \lim_{x\to0}\frac{sinx}{x}\times\frac{1-\cos x}{x^2}\times\frac{1}{\cos x} = 1\times\lim_{x\to0}\frac{1-\cos x}{x^2}\times\frac{1}{1}$
$= \lim_{x\to0}\frac{sinx}{2x}$ [By L's Hospital rule)
$= \lim_{x\to0}\frac{\cos x}{2} = \frac{1}{2}$

79) d $x^y = e^{x-y}$
Taking log on both sides,
$y\log x = x - y$
$y(1+\log x) = x$
$y = \frac{x}{1+\log x}$
$\frac{dy}{dx} = \frac{(1+\log x).1-x.\frac{1}{x}}{(1+\log x)^2} = \frac{\log x}{(1+\log x)^2}$

80) b $\int_0^1 \frac{1}{(x^2+1)^{3/2}}dx$
Put $x = \tan\theta$
For $x = 0, \theta = 0$
$\therefore I = \int_0^{\pi/4}\frac{sec^2\theta\ d\theta}{sec^3\theta\ d\theta} = \int_0^{\pi/4}\cos\theta\ d\theta = |\cos\theta|_0^{\pi/4} = \cos 0 - \cos\frac{\pi}{4} = \frac{1}{\sqrt{2}}$

81) d Volume (V) = $\frac{4}{3}\pi r^3$
$\frac{dV}{dt} = \frac{4}{3}\pi.3r^2.\frac{dr}{dt}$
$2 = 4\pi.(12)^2.\frac{dr}{dt}$
$\frac{dr}{dt} = \frac{1}{288\pi}$
Now, area = $4\pi r^2$
$\frac{dA}{dt} = 4\pi.2r.\frac{dr}{dt} = 8\pi.12.\frac{1}{288\pi} = \frac{1}{3}$

82) b Required area = $\int_0^2 y\ dx = \int_0^2\frac{x^2}{4}\ dx = \left|\frac{x^3}{12}\right|_0^2 = \frac{2^3}{12} = \frac{2}{3}$ sq. units

83) d Equation of bisector of 1st equation:
$h(x^2-y^2) = (a-b)xy$
$(x^2-y^2) = \frac{(a-b)}{h}xy$ --- (1)
For 2nd equation of bisector,
$h'(x^2-y^2) = (a'-b')\ xy$
$(x^2-y^2) = \frac{(a'-b')}{h'}xy$ --- (2)
From (1) and (2),
$\frac{h}{h'} = \frac{(a-b)}{(a'-b')}$

84) d $x^2+y^2-2x-4y+7 = 0$
Centre (h, k) = (-g, -f) = (1, 2)
The new circle passes through (1, 2) and has same centre.
Radius = $\sqrt{(3-1)^2+(4-2)^2} = \sqrt{8}$
Now, Equation of circle becomes:
$(x-1)^2+(y-2)^2 = (\sqrt{8})^2$
On solving, we get,
$x^2+y^2-2x-4y-3 = 0$

85) b Centre (0, 3) and directrix parallel to x-axis;
So, ellipse has its major axis along y-axis.
Major axis $= 2b = 12$
$b = 6$
Eccentricity (e) = 1/2
$\sqrt{1-\frac{a^2}{b^2}} = \frac{1}{2}$
$1-\frac{a^2}{b^2} = \frac{1}{4}$

$1-\frac{a^2}{36}=\frac{1}{4}$
$a^2=27$
So, equation of ellipse becomes:
$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$
$\frac{x^2}{27}+\frac{(y-3)^2}{36}=1$

86) c Equation of plane is: $2x-3y+6z-11=0$
$\vec{n}=2\hat{\imath}-3\hat{\jmath}+6\hat{k}$
Equation of line is:
$\hat{b}=\hat{\imath}$
$\sin\theta=\frac{\vec{b}.\vec{n}}{|\vec{b}||\vec{n}|}$
$\sin(\sin^{-1}\lambda)=\frac{(2\hat{\imath}-3\hat{\jmath}+6\hat{k}).(\hat{\imath}+0\hat{\jmath}+0\hat{k})}{\sqrt{(2)^2+(-3)^2+(6)^2}.\sqrt{(1)^2}}$
$\lambda=\frac{2}{\sqrt{49}}=\frac{2}{7}$

87) a Time taken by body A, $t_1=5\ s$
Acceleration of body A = a_1
Time taken by body B, $t_2=5-2=3\ s$
Acceleration of body B = a_2
Distance covered by first body in 5th second after its start,
$S_5=u+\frac{a_1}{2}(2t_1-1)=0+\frac{a_1}{2}(2\times5-1)=\frac{9}{2}a_1$
Distance covered by the second body in 3rd second after its start,
$S_3=u+\frac{a_2}{2}(2t_2-1)=0+\frac{a_2}{2}(2\times3-1)=\frac{5}{2}a_2$
Since, $S_5=S_3$
or, $\frac{9}{2}a_1=\frac{5}{2}a_1$
$a_1:a_2=5:9$

88) b Here, $u=15\ ms^{-1}, h=490\ m$
Time taken by the stone to reach the ground is:
$t=\sqrt{\frac{2h}{g}}=\sqrt{\frac{2\times490}{9.8}}=10\ s$

89) c If m is the mass of the ball, then its total initial energy at height h $=\frac{1}{2}mu^2+mgh$
Energy after collision $=50\%$ of $\left(\frac{1}{2}mu^2+mgh\right)=\frac{1}{2}\left(\frac{1}{2}mu^2+mgh\right)$
As the ball rebounds to height h, so
$\frac{1}{2}\left(\frac{1}{2}mu^2+mgh\right)=mgh$
or, $\frac{1}{2}mu^2=\frac{1}{2}mgh$
$u=\sqrt{2gh}=\sqrt{2\times9.8\times10}=14\ m/s$

90) d Here, Surface tension (S) $=2.5\times10^{-2}\ Nm^{-1}$
$r=6\ mm=6\times10^{-3}\ m$
Excess pressure inside the soap bubble,
$P=\frac{4S}{r}=\frac{4\times2.5\times10^{-2}}{6\times10^{-3}}=16.7\ Pa$

91) a As $V_T=V_0(1+\gamma\Delta T)$
$\frac{V_T-V_0}{V_0}=\gamma\Delta T$
$\frac{0.24}{100}=40\ \gamma$
$\gamma=\frac{0.24}{100\times40}=6\times10^{-5}\ {}^\circ C^{-1}$
Coefficient of linear expansion $\alpha=\frac{\gamma}{3}=\frac{6\times10^{-5}}{3}=2\times10^{-5}\ {}^\circ C^{-1}$

92) d Work done in isothermal process is:
$W=nRT\ln\frac{V_2}{V_1}=1\times8.31\times310\times\ln\frac{2V_1}{V_1}=1.786\times10^3$
Amount of heat absorbed $=\frac{1.786\times10^3}{4.2}$ cal = 425.4 cal

93) c $T_m=2\pi\sqrt{\frac{l}{g_m}}$ and $T_e=2\pi\sqrt{\frac{l}{g_e}}$
$\frac{T_m}{T_e}=\sqrt{\frac{g_e}{g_m}}$

$T_m = \sqrt{\frac{g_e}{g_m}} \times T_e = \sqrt{\frac{9.8}{1.7}} \times 3.5 = 8.4\ s$

94) b The given equation of a wave is:

$y = 10 \sin\left(\frac{2\pi}{45} t + \alpha\right)$

At $t = 0, y = 5\ cm$

$5 = 10 \sin \alpha$

$\frac{1}{2} = sin\alpha$

$\alpha = \frac{\pi}{6}$

Hence, the total phase at t= $7.5\ s$ is:

$\phi = \frac{2\pi}{45} \times 7.5 + \alpha = \frac{\pi}{3} + \frac{\pi}{6} = \frac{3\pi}{6} = \frac{\pi}{2}$

95) a When a charged capacitor of capacitance C_1 is connected in parallel to an uncharged capacitor of capacitance C_2, the charge is shared between them till both attain the common potential which is given by:

$V' = \frac{q_1+q_2}{C_1+C_2} = \frac{C_1V+0}{C_1+C_2} = \frac{C_1V}{C_1+C_2}$

96) b In first case, $12 = E - 2r$ --- (1)

In second case, $15 = E + 3r$--- (2)

Subtract (2) from (1), we get, $r = \frac{3}{5}\ \Omega$

From (1),

$12 = E - 2 \times \frac{3}{5}$

$E = 12 + \frac{6}{5} = \frac{66}{5}$

97) c As, $B_V = \sqrt{3}\ B_H$

Also, $\tan\delta = \frac{B_V}{B_H} = \frac{\sqrt{3}B_H}{B_H} = \sqrt{3}$

$\delta = \tan^{-1}(\sqrt{3}) = 60^\circ$

98) b Current in the circuit, $I = \frac{V}{Z} = \frac{220}{44} = 5\ A$

Power dissipated in the circuit, $P = I^2R = 5^2 \times 22 = 550\ W$

99) a Here, $u = -40\ cm, v = +80\ cm, f = ?$

$\frac{1}{f} = \frac{1}{80} - \frac{1}{-40} = \frac{1+2}{80} = \frac{3}{80}$

Now,

$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$

$\frac{1}{f_2} = \frac{3}{80} - \frac{1}{25} = \frac{15-16}{400} = -\frac{1}{400}$

$f_2 = -400\ cm$

100) a As $eV_0 = h(v - v_0)$

$V_0 = \frac{h(v-v_0)}{e} = \frac{6.63\times10^{-34}(8.2\times10^{14}-3.3\times10^{14})}{1.6\times10^{-19}} = 2\ V$

Thank You!!!!!!