

PHYSICS

SECTION - 1

Only One Option Correct Type

This section contains 5 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE Option is correct**.

- The band gap in germanium is $\Delta E = 0.68$ eV. Assuming that the number of hole-electron pairs is proportional to $\frac{-\Delta E}{e^{2KT}}$, find the percentage increase in number of charge carriers in pure germanium as the temperature is increased from 300 K to 320 K. (Given $e^{0.82} = 2.27$)
(A) 11 % (B) 81 % (C) 107 % (D) 127 %
- A radioactive sample decays with an average life of 20 ms. A capacitor of capacitance 100 μF is charged to some potential and then the plates are connected through a resistance R . What should be value of R so that the ratio of the charge on the capacitor to the activity of the radioactive sample remains constant in time?
(A) 200 Ω (B) 100 Ω (C) 50 Ω (D) ∞
- A small particle of mass m moves in such a way that the potential energy $U = \frac{1}{2}m^2k^2r^2$, where k is a constant and r is the distance of the particle from origin. Assuming Bohr's model of quantization of angular momentum and circular orbits, the radius of n^{th} allowed orbit is proportional to
(A) n (B) n^{-1} (C) $n^{\frac{1}{2}}$ (D) n^2
- A galaxy moving with speed of $300 \frac{\text{km}}{\text{s}}$ shows blue shift. At what wavelength sodium line at 589.0 nm will be observed?
(A) 588.411 nm (B) 589.5 nm (C) 0.589 nm (D) 588.6 nm
- A parallel beam of green light of wavelength 546 nm passes through a slit of width 0.40 mm. The transmitted light is collected on a screen 40 cm away. Find the distance between the two first order minima.
(A) 1.1 nm (B) 2.2 nm (C) 3.3 nm (D) 4.4 nm

SECTION - 2

Comprehension Type (Only One Option Correct)

This section contains 1 paragraphs, each describing theory, experiments, data etc. Three questions related to the one paragraphs with three questions on each paragraph. Each question has only one correct answer among the four given options (A), (B), (C) and (D).

Paragraph for Questions 6 and 8

A particle known as μ meson has a charge equal to that of an electron and mass 208 times the mass of an electron. It moves in a circular orbit around a nucleus of charge $+3e$. Take the mass of nucleus to be ∞ . Assuming Bohr's model to be applicable

- Value of n for which radius of the orbit is approximately the same as that of the first Bohr orbit for a H-atom.
(A) 5 (B) 25
(C) 75 (D) 100

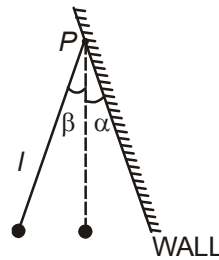
7. Find the wavelength of the radiation emitted when the μ -meson jumps from the 3rd orbit to the first orbit.
 (A) 50 pm (B) 55 pm (C) 60 pm (D) 65 pm
8. Find the wavelength of the radiation emitted when the μ -meson jumps from the 3rd orbit to the second orbit.
 (A) 50 pm (B) 55 pm (C) 60 pm (D) None of these

SECTION - 3

One or More Than One Options Correct Type

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

9. A small ball is suspended with the help of an inextensible light string of length l at the point P of a wall which forms an angle α with downward vertical direction. The bob is deviated through angle β . Both β and α are small. The impact between ball and wall is elastic.



- (A) If $\beta = \frac{\alpha}{2}$, the period of oscillation is $T = 2\pi\sqrt{\frac{l}{g}}$
- (B) If $\beta = \frac{\alpha}{2}$, the period of oscillation is $T = \pi\sqrt{\frac{l}{g}}$
- (C) If $\beta = 2\alpha$, the period of oscillation is $\frac{4\pi}{3}\sqrt{\frac{l}{g}}$
- (D) If $\beta = 2\alpha$, the period of oscillation is $\frac{2\pi}{3}\sqrt{\frac{l}{g}}$
10. A metal disc of radius r rotates in its own plane with constant angular velocity ω , about its axis.
- (A) The potential difference developed between centre and edge is $\frac{m\omega^2 R^2}{2e}$ (e is electronic charge)
 (No magnetic field exist)
- (B) The potential difference developed between centre and edge is $\frac{m\omega^2 R^2}{e}$
- (C) The potential difference developed between centre and edge if a uniform magnetic field is applied perpendicular to disc, is $\frac{B\omega^2 R^2}{2}$
- (D) The potential difference developed between centre and edge if a uniform magnetic field B is applied perpendicular to disc, is $\frac{B\omega R^2}{2}$
11. Two resistive wires have resistances R_{10} and R_{20} at $^{\circ}\text{C}$ such that $R_{20} = 3 R_{10}$, Their temperature coefficient of resistances are α_1 and α_2 respectively such that $\alpha_2 = 3\alpha_1$
- (A) When they are connected in series, the effective value of α , is $2.5 \alpha_1$
- (B) When they are connected in series, the effective value of α , is $2.25 \alpha_1$
- (C) In parallel $\alpha_{\text{eff}} = 1.5 \alpha_1$
- (D) In parallel $\alpha_{\text{eff}} = 2.5 \alpha_1$

12. Current I is flowing in a circular loop of radius R . The
- (A) Strength of magnetic field at an axial point, distant $R\sqrt{3}$ from centre of loop is $\frac{\mu_0 I}{8R}$
- (B) Strength of magnetic field at distant $R\sqrt{3}$ upon axis, from the centre, is $\frac{\mu_0 I}{16R}$
- (C) Magnetic field strength at the centre, is $\frac{\mu_0 I}{2R}$
- (D) Magnetic field strength at the centre, is $\frac{\mu_0 I}{2\pi R}$

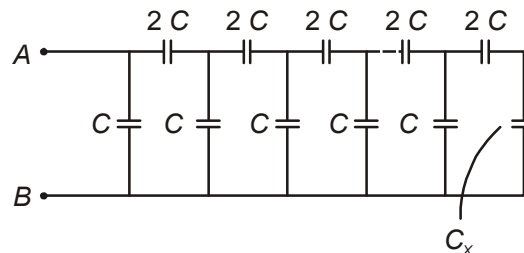
SECTION - 4

One Integer Value Correct Type

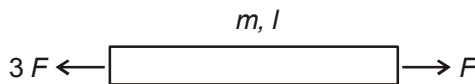
This section contains 6 questions. The answer to each of the question is a single digit integer, ranging from 0 to 9 (both inclusive). The appropriate bubbles corresponding to the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y and Z (say) are 6, 0 and 9, respectively, then the correct darkening of bubbles will look like the following:

X	0	1	2	3	4	5	6	7	8	9
Y	0	1	2	3	4	5	6	7	8	9
Z	0	1	2	3	4	5	6	7	8	9

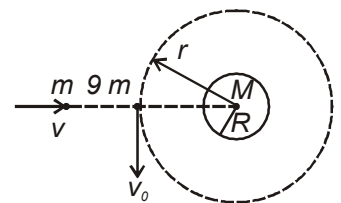
13. The value of C_x such that effective capacitance between points A and B is independent of number of sections in the networks of capacitors, if $C = 2 \mu\text{F}$. Find C_x in μF .



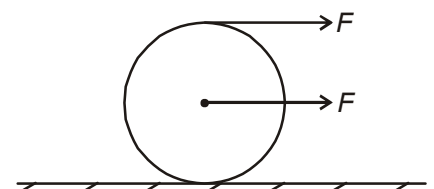
14. In a certain polytropic process for ideal diatomic gas, if the volume is doubled, the pressure becomes one-fourth. The molar heat capacity for the process is $\frac{3R}{N}$. Find the value of N .
15. An elastic rod (m, l) is being pulled as shown in figure. The tension in rod at mid point is NF . Find 'N'



16. A satellite of mass $9m$, is orbiting around a planet of mass M , radius R , in circular orbit of radius r . An object of mass m , moving with velocity v (as shown in figure) collides with satellite and sticks with it. Take $v = \sqrt{19} v_0$. If speed of combined body is $N v_0$. Find N .



17. The density of a newly discovered planet is twice that of the earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of earth. If the radius of the earth is R and radius of the planet is R' , then what is the value of $\frac{R}{R'}$?
18. Two forces of magnitude F are acting on a uniform disc kept on a horizontal rough surface as shown. Friction force by the horizontal surface on the disc is nF . Find the value of n , if the disc rolls without slipping.



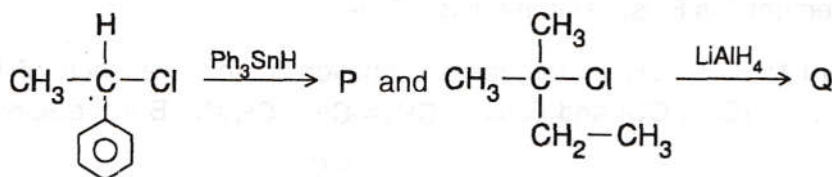
CHEMISTRY

SECTION - 1

Only One Option Correct Type

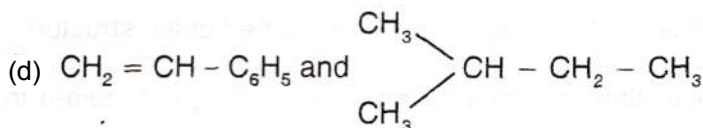
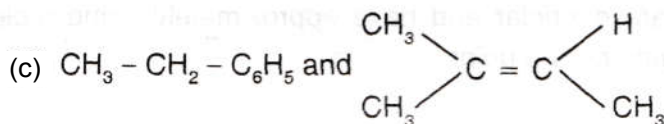
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19. The density of silver is 105 g/cm^3 and it crystallises in a FCC structure. The radius of silver atom is
 (a) 150 pm (b) 100 pm (c) 120 pm (d) 144.6 pm
20. Sodium thiosulphate solution is treated with AgNO_3 solution. This causes the precipitation of a white substance which changes rapidly to black through yellow, orange and brown colours. The white and the black precipitates are respectively
 (a) $\text{Ag}_2\text{SO}_4, \text{Ag}_2\text{S}$ (b) $\text{Ag}_2\text{S}_2\text{O}_3, \text{Ag}$
 (c) $\text{Ag}_2\text{S}_2\text{O}_3, \text{Ag}_2\text{S}$ (d) $\text{Na}_3[\text{Ag}(\text{S}_2\text{O}_3)_2], \text{Ag}_2\text{S}$
21. The atomic radii of transition metals (from left to right)
 (a) regularly decrease from left to right
 (b) increase first, reach a maximum and then decrease
 (c) decrease from left to right and remains practically same after midway of the series
 (d) remains practically the same from left to right
22. LiAlH_4 and Ph_3SnH act as reducing agents. In the following reactions,

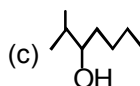
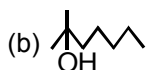
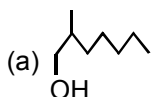


The products P and Q are respectively

- (a) $\text{CH}_3 - \text{CH}_2 - \text{C}_6\text{H}_5$ and $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$
 (b) $\text{CH}_2 = \text{CH} - \text{C}_6\text{H}_5$ and $(\text{CH}_3)_2\text{C} = \text{CH} - \text{CH}_3$



23. Identify the final product of the oxymercuration-demercuration of 



SECTION - 2

Comprehension Type (Only One Option Correct)

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Paragraph for Questions 24 and 26

Compounds containing C and H alone are called hydrocarbons. They may be saturated unsaturated, cyclic or aromatic hydrocarbons. Depending upon the bond present between carbon atoms in the chain, the hydrocarbons differ in their chemical properties.

24. $\text{CH}_3 - \text{CH}_2 - \text{C} \equiv \text{C} - \text{H}$ and $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3$ differ in some of the following reactions.
- (i) with Na (ii) with Na and liquid NH_3
 (iii) with H_2 and Pt (iv) H_2SO_4 and Hg^{2+}
- (a) (i), (ii) and (iii) (b) (ii), (iii) and (iv)
 (c) (i) and (ii) (d) (iii) and (iv)
25. A hydrocarbon having the formula C_6H_{10} absorbs only one molecule of H_2 upon catalytic hydrogenation. On ozonolysis the hydrocarbon gives $\text{OHC} - (\text{CH}_2)_4 - \text{CHO}$. The hydrocarbon is
- (a) cyclohexene (b) methyl cyclopentane
 (c) hex-1, 5 diene (d) cyclohexyne
26. By Kolbe's electrolytic reaction, hydrocarbons can be formed. Which of the following will not produce the hydrocarbon?
- (a) $\text{CH}_3 - \text{COONa}(\text{aq})$ (b) $\begin{array}{c} \text{CH}_2 - \text{COONa} \\ | \\ \text{CH}_2 - \text{COONa}(\text{aq}) \end{array}$
 (c) $\text{C}_6\text{H}_5 - \text{COONa}(\text{aq})$ (d) $\begin{array}{c} \text{CH} - \text{COONa} \\ || \\ \text{CH} - \text{COONa}(\text{aq}) \end{array}$

SECTION - 3

One or More Than One Options Correct Type

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE THAN ONE** are correct.

27. The statements that are true among the following are
- (a) PBr_5 exists as $[\text{PBr}_4]^{\oplus} [\text{PBr}_6]^{\ominus}$
 (b) Nitrite is both oxidizing and reducing agent
 (c) Bi_2O_3 is only basic and not acidic and is insoluble in alkali
 (d) The oxidation state of Fe in brown ring complex is + 1
28. The order of reactivity of alcohol is $1^\circ > 2^\circ > 3^\circ$ in
- (a) esterification (b) reaction with Na (c) reaction with NaH (d) reaction with HCl
29. During esterification reaction, which is the correct order of rate of the reaction?
- (a) $\text{CH}_3\text{OH} > \text{C}_2\text{H}_5\text{OH} > \text{C}_3\text{H}_7\text{OH}$
 (b) $(\text{CH}_3)_3\text{C} - \text{OH} > (\text{CH}_3)_2\text{CH} - \text{OH} > \text{CH}_3 - \text{CH}_2 - \text{OH}$
 (c) $\text{HCOOH} > \text{CH}_3\text{COOH} > (\text{CH}_3)_2\text{CH} - \text{COOH}$
 (d) $\text{CH}_3 - \text{CH}_2 - \text{COOH} > \text{CH}_3\text{COOH} > \text{HCOOH}$

30. Pick out the correct statements.

- (a) An electron accelerated through a potential difference of 150 volt has a wavelength of 1Å
- (b) Uncertainty principle is applicable to subatomic particles
- (c) Electron microscope is based upon particle nature of moving electron
- (d) de Broglie waves cannot be transmitted into space

SECTION - 4

One Integer Value Correct Type

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31. Co-efficient of Cl₂ on balancing the equation to the simplest integers is



32. A compound PdCl₄·6H₂O is a hydrated complex; 1 molal aqueous solution of it has freezing point 269.28 K. Assuming 100% ionisation of complex, the vant Hoff factor for the complex will be (K_f for water = 1.86 K kg mol⁻¹)

33. At 298 K, the EMF of the cell,



the standard reduction potential of the calomel electrode is 0.2802 V.

If the liquid junction potential is zero, the pH of the anodic solution is

34. When one molecule of IF₇, is completely hydrolysed then how many molecule(s) of oxoacid form?

35. Maximum number of equal P – O bonds in P₂O₇⁴⁻ ion is

36. What is the molarity of H₂O₂ of the 11.2 V(volume strength) H₂O₂ sample?

MATHEMATICS

SECTION - 1

Only One Option Correct Type

This section contains 5 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE Option is correct**.

37. If ABCD is a cyclic quadrilateral such that $12\tan A - 5 = 0$ and $5\cos B + 3 = 0$ then the quadratic equation whose roots are $\cos C, \tan D$ is
 (A) $39x^2 - 16x - 48 = 0$ (B) $39x^2 + 88x + 48 = 0$
 (C) $39x^2 - 88x + 48 = 0$ (D) None of these
38. Consider two quadratic expressions $f(x) = ax^2 + bx + c$ and $g(x) = ax^2 + px + q$, ($b \neq p$) such that their discriminants are equal. If $f(x) = g(x)$ has a root $x = \alpha$, then :
 (A) α will be A.M. of the roots of $f(x) = 0$ and $g(x) = 0$
 (B) α will be A.M. of the roots of $f(x) = 0$
 (C) α will be A.M. of the roots of $g(x) = 0$
 (D) none of these
39. If the circle $C_1: x^2 + y^2 = 16$ intersects another circle C_2 of radius 5 in such a manner that the common chord is of maximum length and has a slope equal to $3/4$, then the co-ordinates of the centre of C_2 are:
 (A) $\left(\pm \frac{9}{5}, \pm \frac{12}{5}\right)$ (B) $\left(\pm \frac{9}{5}, \mp \frac{12}{5}\right)$ (C) $\left(\pm \frac{12}{5}, \pm \frac{9}{5}\right)$ (D) $\left(\pm \frac{12}{5}, \mp \frac{9}{5}\right)$
40. The probability that when 12 distinct balls are distributed among three boxes, the first will contain three ball is
 (A) $\frac{2^9}{3^{12}}$ (B) $\frac{{}^{12}C_9 \cdot 2^9}{9^6}$ (C) $\frac{{}^{12}C_3 \cdot 2^{12}}{3^{12}}$ (D) none of these
41. The area between the curves $y = \ln x$ and $y = \ln \frac{1}{x}$ when $1 \leq x \leq e$ is
 (A) 2 (B) $\ln 2$ (C) $\ln \frac{4}{e}$ (D) $\frac{1}{2}$

SECTION - 2

Comprehension Type (Only One Option Correct)

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Paragraph For Questions 42 and 44

Let f be a function defined so that every element of the codomain has at most two pre-images and there is at least one element in the co-domain which has exactly two pre-images we shall call this function as "two-one" function. A two-one function is definitely a many one function but vice-versa is not true. For example, $y = |e^x - 1|$ is a "two-one" function. $y = x^3 - x$ is a many one function but not a "two-one" function. In the light of above definition answer the following questions:

42. In the following functions which one is a "two-one" function :-
 (A) $y = |\ln|x||$ (B) $y = x^2 \sin x$ (C) $y = x^3 + 3x + 1$ (D) $y = x^4 - x + 1$
43. Let $f(x) = \{x\}$ be the fractional part function. For what domain is the function "two-one"?
 (A) $\left[\frac{1}{2}, \frac{5}{2}\right]$ (B) $\left[-\frac{1}{2}, \frac{3}{2}\right]$ (C) $[1, 2)$ (D) none of these
44. A continuous "two-one" function defined for $x \in (a, b)$ has
 (A) atmost one point of extremum (B) atleast two points of extrema
 (C) exactly one point of extremum (D) none of these

SECTION - 3

One or More Than One Options Correct Type

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45. Consider a circle with its centre lying on the focus of the parabola, $y^2 = 2px$ such that it touches the directrix of the parabola. Then a point of intersection of the circle & the parabola is:
 (A) $\left(\frac{p}{2}, p\right)$ (B) $\left(\frac{p}{2}, -p\right)$ (C) $\left(-\frac{p}{2}, p\right)$ (D) $\left(-\frac{p}{2}, -p\right)$
46. If the normal at any given point P on ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ meets its auxiliary circle at Q and R such that $\hat{QOR} = 90^\circ$, where O is centre of ellipse, then :
 (A) $2(a^2 - b^2)^2 = a^4 \sec^2 \theta + a^2 b^2 \operatorname{cosec}^2 \theta$ (B) $a^4 + 5a^2 b^2 + 2b^4 = a^4 \tan^2 \theta + a^2 b^2 \cot^2 \theta$
 (C) $a^4 + 5b^2 a^2 + 2b^4 \geq 2a^3 b$ (D) $a^4 + 2b^4 \geq 5a^2 b^2 + 2a^3 b$
47. If $x_i > 0, i = 1, 2, 3, \dots, 50$ and $x_1 \cdot x_2 \cdot \dots \cdot x_{50} = K$ then
 (A) $x_1 + x_2 + \dots + x_{50} \geq 50 \sqrt[50]{K}$
 (B) $x_1 + x_2 + \dots + x_{50} \geq 50 \sqrt[50]{K}$ if x_1, x_2, \dots, x_{50} are in G.P. with common ratio $\neq 1$
 (C) $\frac{1}{x_1} + \frac{1}{x_2} + \dots + \frac{1}{x_{50}} > \frac{50}{\sqrt[50]{K}}$ if x_1, x_2, \dots, x_{50} are in G.P. with common ratio $\neq 1$
 (D) $\frac{1}{x_1} + \frac{1}{x_2} + \dots + \frac{1}{x_{50}} \geq \frac{50}{\sqrt[50]{K}}$
48. A square matrix A with elements from the set of real numbers is said to be orthogonal if $A' = A^{-1}$. If A is an orthogonal matrix, then
 (A) A' is orthogonal (B) A^{-1} is orthogonal (C) $\operatorname{Adj} A = A'$ (D) $|A^{-1}| = 1$

SECTION - 4

One Integer Value Correct Type

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Z	0	1	2	3	4	5	6	7	8	9

49. In a regular tetrahedron let θ be the angle between any edge and a face not containing the edge. If $\cos^2 \theta = \frac{a}{b}$ where $a, b \in I^+$ also a and b are coprime, then find the value of $10a + b$
50. The hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ passes through the point of intersection of the lines $x - 3\sqrt{5}y = 0$ and $\sqrt{5}x - 2y = 13$ and the length of its latus rectum is $\frac{4}{3}$ units. Find the value of $9e^2$ where e is the eccentricity of the hyperbola.
51. The locus of a point that divides a chord of slope 2 of the parabola $y^2 = 4x$ internally in the ratio 1 : 2 is a parabola with vertex (a, b) and length of latus rectum ℓ . Then find the value of $81(a + b\ell)$

52. Let the values of 'a' for which the roots of the equation $(x - a)(x - a - 1) = 0$ lie between the roots of the equation $(x + a)(x + a^2 - 2) = 0$ be $a \in (-\infty, p) \cup \left(q, \frac{-1 + \sqrt{5}}{2} \right)$. Find the value of $q - p$.
53. A best of 9 games series is to be played between two teams A & B (i.e. the first team to win 5 games is the winner). Team A wins any given game with probability $\frac{2}{3}$. If the winner is decided in exactly 7 games and the chance that team A will be the winning team is p then find the sum of the series $p + p^2 + p^3 + \dots + \infty$.
54. If all values of $x \in (a, b)$ satisfy the inequality $\tan x \tan 3x < -1$, $x \in \left(0, \frac{\pi}{2} \right)$, then find the maximum value of $\frac{36}{\pi} (b - a)$

(SPACE FOR ROUGH WORK)



JEE-ADVANCED (FULL TEST-3)

16-04-2017

(ANSWER KEY)

1	(d)	2	(a)	3	(c)	4	(a)	5	(a)
6	(b)	7	(b)	8	(d)	9	(a,c)	10	(a,d)
11	(a,c)	12	(b,c)	13	4	14	2	15	2
16	1	17	2	18	0	19	(d)	20	(c)
21	(c)	22	(c)	23	(b)	24	(c)	25	(a)
26	(c)	27	(b,c,d)	28	(a,c,d)	29	(a,c)	30	(a,b,d)
31	5	32	2	33	8	34	1	35	8
36	1	37	(a)	38	(a)	39	(b)	40	(b)
41	(a)	42	(d)	43	(b)	44	(d)	45	(a,b)
46	(a,d)	47	(a,b,c)	48	(a,b)	49	13	50	10
51	50	52	2	53	8	54	3		

(ANSWER KEY)

1	(d)	2	(a)	3	(c)	4	(a)	5	(a)
6	(b)	7	(b)	8	(d)	9	(a,c)	10	(a,d)
11	(a,c)	12	(b,c)	13	4	14	2	15	2
16	1	17	2	18	0	19	(d)	20	(c)
21	(c)	22	(c)	23	(b)	24	(c)	25	(a)
26	(c)	27	(b,c,d)	28	(a,c,d)	29	(a,c)	30	(a,b,d)
31	5	32	2	33	8	34	1	35	8
36	1	37	(a)	38	(a)	39	(b)	40	(b)
41	(a)	42	(d)	43	(b)	44	(d)	45	(a,b)
46	(a,d)	47	(a,b,c)	48	(a,b)	49	13	50	10
51	50	52	2	53	8	54	3		