

# Gate Mock Test

with Solution

Mechanical  
By: Mr. Arvind Rai



**i-Gate Mentor**

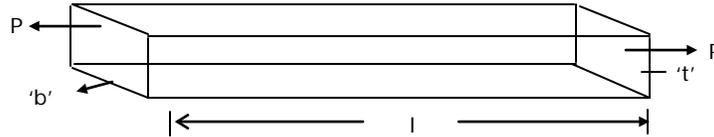


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## GROUP I

**Question No.1 to 25** will carry 1 mark each for every correct answer and there will be a negative mark of 1/3 for every wrong answer. Marks will not be reduced if the question is not attempted.

1.



Consider the above bar of length  $l$ , breadth  $b$  and thickness ' $t$ ' subjected to an axial pull of ' $P$ ' Newton,  $\epsilon$  is strain in  $x$  direction. The resulting volumetric strain will be

- (a)  $\epsilon(1 - 2\mu)$       (b)  $2\epsilon(1 - \mu)$       (c)  $\epsilon(1 + 2\mu)$       (d)  $3\epsilon$
2. Shear stress on mutually perpendicular planes are  
(a) zero      (b) equal  
(c) either maximum or minimum      (d) can't be determined
3. The gray body shape factor for radiant heat exchange between a small body (emissivity 0.4) in large enclosure (emissivity 0.5) is  
(a) 0.45      (b) 0.49      (c) 0.40      (d) 0.56
4. An oil of kinematic viscosity 0.25 stokes flows through a pipe of 10 cm diameter. The flow is critical at a velocity of about  
(a) 0.5 m/sec      (b) 1.5 m/sec      (c) 2.8 m/sec      (d) 4.6 m/sec
5. A hot metal piece kept in air cools from  $80^\circ\text{C}$  to  $70^\circ\text{C}$  in  $t_1$  seconds, from  $70^\circ\text{C}$  to  $60^\circ\text{C}$  in  $t_2$  seconds and from  $60^\circ\text{C}$  to  $50^\circ\text{C}$  in  $t_3$  seconds, then  
(a)  $t_1 = t_2 = t_3$       (b)  $t_1 < t_2 < t_3$   
(c)  $t_1 > t_2 > t_3$   
(d)  $t_1, t_2, t_3$  will depend upon material of hot piece.
6. Which is the control chart for percent defective or fraction defectives.  
(a)  $\bar{X}$  - chart      (b) P - chart      (c) R - chart      (d) C - chart
7. In which non-conventional machining methods, tool wear is absent.  
(a) AJM      (b) USM      (c) EDM      (d) ECM

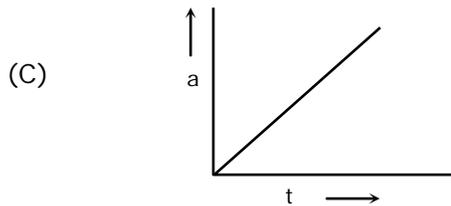
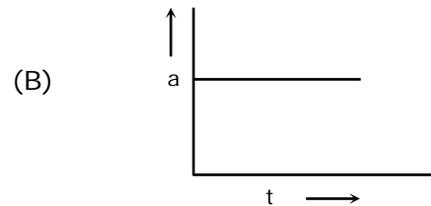
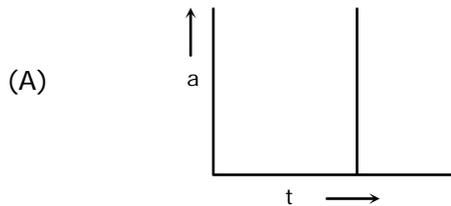
8.  $\lim_{x \rightarrow \pi} \frac{\sin^2\left(\frac{x}{\pi}\right)}{(\pi - x)}$

- (a) 0                                      (b)  $-\pi$                                       (c)  $\pi$                                       (d) 1

9. Which of the following is not a cold working process.

- (a) slitting                                      (b) blanking                                      (c) lancing                                      (d) extrusion

10. The displacement of a particle along the x-axis is given by  $x = 2t^2 + 5t + 7$ , which of the following represents the correct graph for the acceleration of the particle



(D) none of these

11. For high speed which wheel is suitable.

- (a) Resinoid and rubber bonded                                      (b) Silicate bonded  
(c) Shellac bonded                                      (d) Vitrefid wheel

12. In case of power failure, a battery is used to light a bulb, run a fan and heat an electric iron (each of 100w rating) for 10 minutes. In this operation work done and heat supplied Q by battery is

- (a)  $W = 0, Q = 0$                                       (b)  $W = 180 \text{ kJ}, Q = 0$   
(c)  $W = 60 \text{ kJ}, Q = 120 \text{ kJ}$                                       (d) None of the above

13. Which of the following steels will be easier to weld

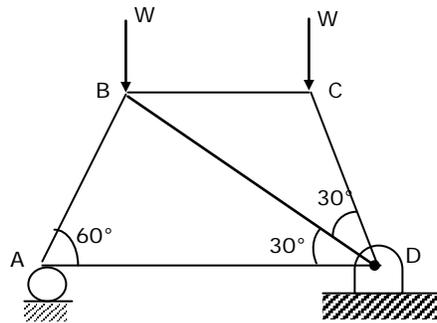
- (a) 0.15% carbon steel                                      (b) 0.5% carbon steel  
(c) 1.0% carbon steel                                      (d) 1.5% carbon steel

14. Optimum Blade speed ratio for a general velocity compounding turbine with 'n' – number of rows of moving blades is

- (a)  $\frac{\cos \alpha_1}{n}$                                       (b)  $\frac{\cos \alpha_1}{2n}$                                       (c)  $\frac{\cos \alpha_1}{4n}$                                       (d)  $\frac{\cos \alpha_1}{8n}$

15. The phenomenon of magnetic arc blow is observed almost exclusively with  
 (a) gas welding (b) spot welding  
 (c) D.C. arc welding (d) thermit welding
16. A stone is projected horizontally from a cliff at 25m/s. At what point from the base of the cliff, stone will hit the ground if height of cliff is 500 m (Take  $g=10\text{m/s}^2$ )  
 (A) 250m (B) 500m (C) 125m (D) none of these
17. A sphere, a cube, and a thin circular plate, all made of same material, having the same mass are initially heated to a temperature of  $250^\circ\text{C}$ . When left in air at room temperature what will be their response to cooling.  
 (a) cool at same rate  
 (b) circular plate will cool at the slowest rate  
 (c) sphere will cool faster  
 (d) cube will cool faster than sphere but slower than circular plate
18. A surface gauge is used to  
 (a) layout the work accurately (b) level the surface plate  
 (c) find flatness of surfaces (d) check the surface finish
19. Given that annual usage = 50 units, procurement cost = Rs.15 per order cost/piece = 100 per item, expenditure on obsolescence, taxes, insurance, deterioration etc = 10%. The economic lot size would be approximately  
 (a) 9 (b) 12 (c) 15 (d) 18
20. An aircraft moves through atmosphere with a velocity of 450 m/sec, if speed of sound in the medium is 300 m/sec, Mach angle will be equal to  
 (a)  $\sin^{-1}\left(\frac{3}{2}\right)$  (b)  $\sin^{-1}\left(\frac{2}{3}\right)$  (c)  $\cos^{-1}\left(\frac{3}{4}\right)$  (d)  $\cos^{-1}\left(\frac{4}{3}\right)$
21. A journal bearing running at 900 rev/min has a bearing pr of  $100\text{ N/cm}^2$ . If lubricant used has an absolute viscosity of 15 centipoise, bearing characteristic no will be equal to  
 (a) 29.8 (b) 13.5 (c) 9.94 (d) 2.85
22. A solid steel shaft of diameter 'd' and length 'l' is subjected to twisting moment T. Another shaft B of Brass having diameter d and length 0.5l, is also subjected to same moment. If shear modulus of steel is two times that of brass, angular twisting of steel and brass would be  
 (a) 1:2 (b) 1:1 (c) 2:1 (d) 4:1

23. For the truss shown in figure, force in the member BC is



- (a) 0.00 N (b) 0.577 W N (Tensive)  
(c) 0.577 W N (comp) (d) 0.866 W N (comp)
24. The symbol used for "inspection" in work-study is  
(a) □ (b) O (c) ⇒ (d) ∇
25. A shell of 200 mm diameter and 200 mm height with the corner radius of 0.4 mm is to be produced by cup-drawing. The required blank diameter is  
(a) 448 mm (b) 224 mm (c) 112 mm (d) 56 mm

## GROUP II

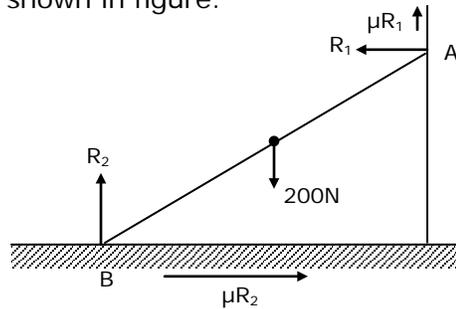
**Question No.26 to 55** will carry 2 marks each for every correct answer and there will be a negative mark of 2/3 for every wrong answer. Marks will not be reduced if the question is not attempted.

26. Consider the system of linear simultaneous equations.  
 $u + 2v + w = 6$   
 $2u + v + 2w = 6$   
 $u + v + w = 5$   
This system has  
(a) unique solution (b) infinite number of solutions  
(c) no solution (d) two solutions
27. The area enclosed between  $x^2 + y^2 = 1$  and straight line  $y = x$  is in the positive quadrant is  
(a)  $\frac{\pi}{8}$  (b)  $\frac{\pi}{6}$  (c)  $\pi$  (d)  $\frac{\pi}{2}$

28. From a set of different balls of colour red, white and Blue, if 2 balls are randomly picked, then find out probabilities of these being of same colour. (red balls =2, white balls = 3, blue balls = 5)
- (a)  $\frac{10}{45}$                       (b)  $\frac{14}{45}$                       (c)  $\frac{12}{45}$                       (d)  $\frac{20}{45}$
29. Tool life in the case of a grinding wheel is the time:
- (a) between two successive regrinds  
 (b) taken for wheel to be balanced  
 (c) taken between two successive wheel dressings  
 (d) taken for a wear 1 mm on its diameter
30. The solution for the following differential equation with the boundary conditions  $y(0) = 2$  and  $y(1) = -3$  is  $\frac{d^2y}{dx^2} = 3x - 2$
- (a)  $\frac{x^3}{2-x^2} - \frac{5x}{2} + 2$                       (b)  $3x^3 - \frac{x^2}{2} - 5x + 2$   
 (c)  $x^3 - \frac{x^2}{2} + 5x + \frac{3}{2}$                       (d)  $\frac{x^2}{3} - \frac{x^2}{2} + 3x - 6$
31. A manufacturer produces two types of products 1 and 2 at production levels  $x_1$  and  $x_2$  respectively. The profit function is  $2x_1 + 5x_2$ . The production constraints are
- $$x_1 + 3x_2 \leq 40$$
- $$3x_1 + x_2 \leq 24$$
- $$x_1 + x_2 \leq 10$$
- $$x_1 > 0, x_2 > 0$$
- The maximum profit, which can meet the constraints is
- (a) 29                      (b) 38                      (c) 44                      (d) 75
32. **Assertion (a):** Aluminum alloys require high melting temperatures compared to zinc alloys  
**Reason (r):** Aluminum alloys are cast in hot chamber die casting machines
- (a) Both [a] and [r] are true and [r] is the correct reason for [a]  
 (b) Both [a] and [r] are true but [r] is not the correct reason for [a]  
 (c) Both [a] and [r] are false  
 (d) [a] is true but [r] is false
33. The flywheel of a steam engine has a radius of gyration of 1 m and mass of 2500 kg. The starting torque of engine is 1500 N-m and remains constant. The angular acceleration of flywheel is equal to

- (a) 0.6 rad/sec<sup>2</sup>      (b) 0.83 rad/sec<sup>2</sup>      (c) 1.2 rad/sec<sup>2</sup>      (d) 1.67 rad/sec<sup>2</sup>

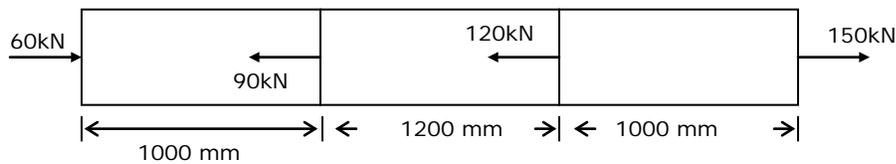
34. A ladder weighing 200 N is placed against a smooth vertical wall and a rough horizontal floor ( $\mu = 0.25$ ) as shown in figure.



If the ladder is just on the point of sliding, then (i) reaction at the point A will be

- (a) 25 N      (b) 50 N      (c) 100 N      (d) 200 N

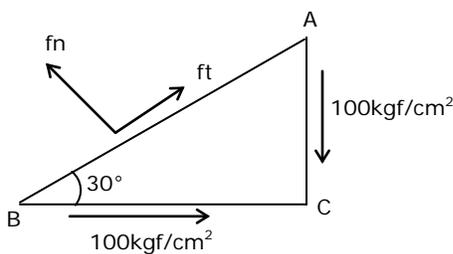
35. A mild steel bar of 20 mm × 20 mm in cross section is subjected to axial forces as shown in figure.



If  $E = 2 \times 10^5 \text{ N/mm}^2$ , then change in length of the portion BC is

- (a) 0.75 mm      (b) 0.45 mm      (c) 15775 mm      (d) 1.875 mm

- 36.



The stress at a point on two perpendicular planes AC and BC are as shown in above figure. The normal stress on a plane AB inclined at  $30^\circ$  to a plane BC will be about

- (a) 50 kgf/cm<sup>2</sup>      (b) 58 kgf/cm<sup>2</sup>      (c) 87 kgf/cm<sup>2</sup>      (d) 115 kgf/cm<sup>2</sup>

37. Two shaft, one hollow and other solid, are to transmit a given torque at a given speed with a prescribed maximum shear stress. The inside diameters of hollow shaft is  $\frac{2}{3}$  of it's outside diameter. The percentage saving of material by accepting the hollow shaft will be



44. Which of the following statements are true:  
 (A) Drag coefficient of plate decreases with increase in Reynolds number  
 (B) Reynolds number decreases in direction of flow over plate  
 (C) Shear stress with in boundary layer increases towards the boundary surface  
 (D) Boundary layer thickness increase along the flow direction  
 (a) A, C, D                      (b) D, B, C                      (c) D, B, A                      (d) A, B, C, D
45. The velocity distribution in a laminar boundary layer over a flat plate has been prescribed by the identity  $\frac{u}{u_o} = \sin\left(\frac{\pi Ay}{\delta}\right)$ . The factor A will have an approximate value of  
 (a)  $\frac{1}{2}$                               (b)  $-\frac{1}{2}$                               (c) 1.0                              (d) 2.0
46. **Assertion[a]:** Four-stroke cycle spark ignition engine have significantly lower bhp and higher bsfc than two stroke cycle engines.  
**Reason[r]:** Because the four stroke engines have lower effective compression ration and poor scavenging as compared to two stroke engines.  
 (a) Both [a] and [r] are true and [r] is the correct reason for [a]  
 (b) Both [a] and [r] are true but [r] is not the correct reason for [a]  
 (c) Both [a] and [r] are false  
 (d) [a] is true but [r] is false
47. **Assertion[a]:**Flexible manufacturing systems are more flexible in producing variety of jobs at comparison to numerical control systems.  
**Reason [r]:**Use of Robots, automatic material handling systems and automatic storage and retrieval system result in better efficiency and productivity in a manufacturing industry.  
 (a) Both [a] and [r] are true and [r] is the correct reason for [a]  
 (b) Both [a] and [r] are true but [r] is not the correct reason for [a]  
 (c) Both [a] and [r] are false  
 (d) [a] is true but [r] is false
48. A heat pump working on a reverse Carnot cycle has a cop of 5. If it works as a refrigerator taking 1 kw of work input, the refrigerating effect will be  
 (a) 1 kW                              (b) 2 kW                              (c) 3 kW                              (d) 4 kW
49. The Rolls Royce Merlin engine working on air-standard Otto cycle has following particulars.  
 Bore = 13.7 cm, Stroke length = 13.0 cm, clearance volume = 280 cm<sup>3</sup>  
 Find out air-standard efficiency  
 (a) 23%                              (b) 37%                              (c) 41%                              (d) 56.2%

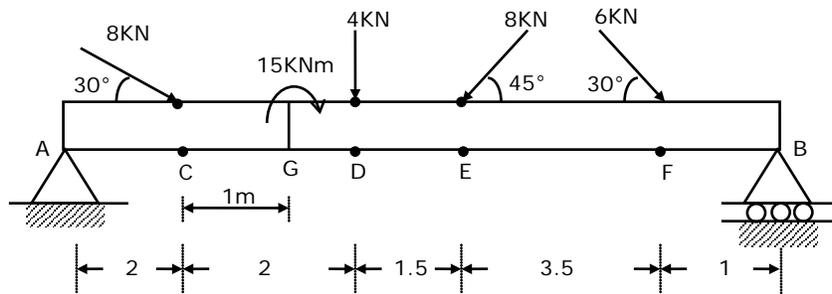
**Common Data for Questions 50 and 51**

In an air standard diesel cycle, the compression ratio is 16, and at the beginning of isentropic compression, the temperature is  $15^{\circ}\text{C}$  and the pressure is 0.1 MPa. Heat is added until the temperature at the end of constant pressure process is  $1480^{\circ}\text{C}$ . (Assume  $R = 0.287 \text{ J/kg K}$ )

50. The heat supplied per kg of air and the cycle efficiency are  
 (A) 540.2 kJ/kg & 31.6% (B) 884.4 kJ/kg & 61.2%  
 (C) 341.8 kJ/kg & 33.3% (D) 420.8 kJ/kg & 64.9%
51. The mean effective pressure will be  
 (A) 333.31 kPa (B) 448.62 kPa (C) 897.32 kPa (D) 698.45 kPa

**Linked Based Questions for Q.52 and Q.53:**

A horizontal beam AB 10m long is hinged at A and simply supported at B. The beam is loaded as shown in the figure.



52. The value of reaction force at A will be:  
 (A) 6.47 kN (B) 7.23 kN (C) 8.58 kN (D) 9.49 kN
53. The maximum bending moment will be:  
 (A) 31.82 kNm (B) 34.76 kNm (C) 33.17 kNm (D) None of these

**Link Based Questions for Q.54 & Q.55**

The pressure exerted by air inside a vessel of volume of  $0.14 \text{ m}^3$  was  $10^6 \text{ N/m}^2$  when the temperature was  $250^{\circ}\text{C}$ . Due to cooling at constant volume, the pressure falls to  $3.5 \times 10^5 \text{ N/m}^2$ .

$C_p = 1.005 \text{ kJ/kg K}, C_v = 0.718 \text{ kJ/kg K}$

54. Determine mass of air in the vessel.  
 (A) 1.2 kg (B) 0.933 kg (C) 1.95 kg (D) 9.30 kg

55. Determine change in entropy  
(A)  $-0.703 \text{ kJ/k}$       (B)  $0.703 \text{ kJ/k}$       (C)  $-1.47 \text{ kJ/k}$       (D)  $1.47 \text{ kJ/k}$

**General Aptitude Questions: Question 56 to 60 carry one mark each**

56. In each of the questions, four different ways of presenting an idea are given. Choose the one that conforms most closely to standard English usage.

(A) Creativity in any field is regarded not only as valuable for itself but also as a service to the nation.

(B) Creativity in any field is not regarded only as valuable on its own, but also as a service to the nation.

(C) Creativity, in any field, is not only regarded as valuable, but also as a service to the nation.

(D) Creativity in any field is regarded not only as valuable in itself but also as a service to the nation.

57. Choose the option in which the usage of the word **Bundle** is INCORRECT or INAPPROPRIATE.

(A) The newborn baby was a bundle of joy for the family.

(B) Mobile operators are offering a bundle of additional benefits.

(C) He made a bundle in the share market.

(D) It was sheer luck that brought a bundle of boy-scouts to where I was lying wounded

58. By selling 11 apples for a dollar a man loses 10%. How many apples for a dollar should be sell to gain 10%?

- (A)9                      (B)10                      (C)11                      (D) 12
59. A, B and C can do a work in 7, 21 and 14 days respectively. If they undertook to finish the work together for Rs. 1210, the share of A exceeds the share of B by
- (A)660                      (B)440                      (C)330                      (D) 220
60. Rs.170 is generated using a combination of 10 ps, 25ps and 50 ps coins. If the ratio of 10 ps, 25 ps and 50 ps coins 5 : 10 : 11, then the total number of coins is :
- (A)100                      (B)200                      (C)220                      (D) 520

**Two Mark Questions**

61. The sentences given in question, when properly sequenced, form a coherent paragraph. Each sentence is labeled with a letter. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.
- A. Surrendered, or captured, combatants cannot be incarcerated in razor wire cages; this 'war' has a dubious legality.
- B. How can then one characterize a conflict to be waged against a phenomenon as war?
- C. The phrase 'war against terror', which has passed into the common lexicon, is a huge misnomer.
- D. Besides, war has a juridical meaning in international law, which has confided the laws of war, imbuing them with a humanitarian content.
- E. Terror is a phenomenon, not an entity – either State or non-State.
- (A) ECDBA (B) BECDA (C) EBCAD (D) CEBDA

**Common data for question 63 and 64**

The controversy over genetically-modified food continues unabated in the West. Genetic modification (GM) is the science by which the genetic material of a plant is altered, perhaps to make it more resistant to pests or killer weeds, or to enhance its nutritional value. Many food biotechnologists claim that GM will be a major contribution of science to

mankind in the 21st century. On the other hand, large numbers of opponents, mainly in Europe, claim that the benefits of GM are a myth propagated by multinational corporations to increase their profits, that they pose a health hazard, and have therefore called for governments to ban the sale of genetically-modified food. The anti-GM campaign has been quite effective in Europe, with several European Union member countries imposing a virtual ban for five years over genetically-modified food imports. Since the genetically modified food industry is particularly strong in the United States of America, the controversy also constitutes another chapter in the US-Europe skirmishes which have become particularly acerbic after the US invasion of Iraq. To a large extent, the GM controversy has been ignored in the Indian media, although Indian biotechnologists have been quite active in GM research. Several groups of Indian biotechnologists have been working on various issues connected with crops grown in India. One concrete achievement which has recently figured in the news is that of a team led by the former vice-chancellor of Jawaharlal Nehru University, Asis Datta—it has successfully added an extra gene to potatoes to enhance the protein content of the tuber by at least 30 percent. Not surprisingly, the new potato has been called the protato. The protato is now in its third year of field trials. It is quite likely that the GM controversy will soon hit the headlines in India since a spokesperson of the Indian Central government has recently announced that the government may use the protato in its midday meal programme for schools as early as next year. Why should "scientific progress", with huge potential benefits to the poor and malnourished, be so controversial? The anti-GM lobby contends that pernicious propaganda has vastly exaggerated the benefits of GM and completely evaded the costs which will have to be incurred if the genetically-modified food industry is allowed to grow unchecked. In particular, they allude to different types of costs. This group contends that the most important potential cost is that the widespread distribution and growth of genetically-modified food will enable the corporate world (alias the

multinational corporations—MNCs) to completely capture the food chain. A "small" group of biotech companies will patent the transferred genes as well as the technology associated with them. They will then buy up the competing seed merchants and seed-breeding centres, thereby controlling the production of food at every possible level. Independent farmers, big and small, will be completely wiped out of the food industry. At best, they will be reduced to the status of being subcontractors. This line of argument goes on to claim that the control of the food chain will be disastrous for the poor since the MNCs, guided by the profit motive, will only focus on the high-value food items demanded by the affluent. Thus, in the long run, the production of basic staples which constitute the food basket of the poor will taper off. However, this vastly overestimates the power of the MNCs. Even if the research promoted by them does focus on the high-value food items, much of biotechnology research is also funded by governments in both developing and developed countries. Indeed, the potato is a by-product of this type of research. If the potato passes the field trials, there is no reason to believe that it cannot be marketed in the global potato market. And this type of success story can be repeated with other basic food items. The second type of cost associated with the genetically-modified food industry is environmental damage. The most common type of "genetic engineering" involves gene modification in plants designed to make them resistant to applications of weed-killers. This then enables farmers to use massive dosages of weedkillers so as to destroy or wipe out all competing varieties of plants in their fields. However, some weeds through genetically-modified pollen contamination may acquire resistance to a variety of weed-killers. The only way to destroy these weeds is through the use of ever-stronger herbicides which are poisonous and linger on in the environment.

62. The author doubts the anti-GM lobby's contention that MNC control of the food chain will be disastrous for the poor because
- (A) MNCs will focus on high-value food items.
  - (B) MNCs are driven by the motive of profit maximization.

(C) MNCs are not the only group of actors in genetically-modified food research.

(D) economic development will help the poor buy MNC-produced food.

63. Using the clues in the passage, which of the following countries would you expect to be in the forefront of the anti-GM campaign?

(A) USA and Spain. (B) India and Iraq

(C) Germany and France. (D) Australia and New Zealand.

64. According to the passage, biotechnology research

(A) is of utility only for high value food items.

(B) is funded only by multinational corporations.

(C) allows multinational corporations to control the food basket of the poor.

(D) is funded mainly by the government of both the rich and poor countries.

65. Twenty-seven persons attend a party. Which one of the following statements can never be true?

(A) There is a person in the party who is acquainted with all the twenty-six others.

(B) Each person in the party has a different number of acquaintances.

(C) There is a person in the party who has an odd number of acquaintances.

(D) In the party, there is no set of three mutual acquaintances.

**ANSWER KEYS For ME: 1**

1A	2B	3C	4A	5B
6B	7D	8A	9D	10B
11A	12B	13A	14B	15C
16A	17D	18A	19B	20B
21B	22C	23C	24A	25A
26C	27A	28B	29A	30A
31A	32D	33A	34B	35B
36C	37B	38A	39D	40A
41A	42A	43C	44A	45A

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