INSTRUCTIONS

1. Use only a No. 2 pencil.

2. Write your name legibly at the top of the FIRST PAGE of the exam.

3. Write and code entire student ID number on the Scantron form.

4. Write in NAME, IMMUNO E1, October 27, and your row and seat number on the front of the form.

5. Fill answer boxes on the Scantron completely; printed numeral should not be visible. Do not make extraneous marks on the form.

6. Mark box A through E, one only. Use A for TRUE and B for FALSE. Each question is intended to have a single best answer.

7. Erase carefully and completely; if in doubt, get a new Scantron.

8. Check your Scantron form before handing it in to see that all questions have been answered.

9. When you are done turn in your exam together with your Scantron.
QUESTIONS 1-9: [4 POINTS] MULTIPLE CHOICE Choose the single best answer

1. A precipitation assay could be used to detect antibodies to which of the following?
   a) DNP
   b) BSA
   c) sheep red blood cells
   d) antigen-coated latex particles

2. Proliferation of B-cells is considered part of which limb of the immune response?
   a) Afferent
   b) Central
   c) Efferent
   d) none of the above

3. The light and heavy chains of an IgG molecule are held to each other by:
   a) covalent bonds
   b) non-covalent bonds
   c) both
   d) neither

4. Memory for which of the following would be transferred by cells from an immune donor to a naïve recipient?
   a) cell-mediated immunity
   b) humoral immunity
   c) both
   d) neither

5. "LD" ("lymphocyte-determined") antigens of the MHC include
   a) Class I
   b) Class II
   c) both
   d) neither

6. Peripheral neuropathy is most commonly observed in:
   a) Waldenstrom’s macroglobulinemia
   b) Smoldering multiple myeloma
   c) IgA MGUS
   d) Multiple myeloma
7. As a naive B-cell differentiates into an IgM-secreting plasma cell, the amount of DNA in its genome:

   a) increases
   b) decreases
   c) remains the same
   d) varies for different B-cells

8. The tumor cells in a patient with leukemia are examined and found to express membrane-bound κIgM. This suggests that the original cell that underwent malignant transformation in this patient was most likely a:

   a) pre-B-cell
   b) naïve B-cell
   c) plasma cell
   d) memory B-cell

9. The most striking result of the congenital absence of antibodies is increased susceptibility to infection by:

   a) fungi
   b) viruses
   c) extracellular bacteria
   d) intracellular bacteria

QUESTIONS 10-14: [2 POINTS] MULTIPLE CHOICE. Choose from the following; each choice may be used once, more than once or not at all.

   a) IgG
   b) IgE
   c) IgM
   d) IgD
   e) IgA

10. _______ Predominant Ig in saliva

11. _______ Predominant Ig in serum

12. _______ Present on membrane of all virgin B-cells

13. _______ Transferred from maternal to fetal circulation during pregnancy

14. _______ Associated with J-chain in serum
QUESTIONS 15-25: [4 POINTS] MULTIPLE CHOICE  Choose the single best answer

15. If you immunize a goat with human transferrin (HTf) and test the resulting antiserum using Ouchterlony, which of the following patterns would you expect to see? (BSA=bovine serum albumin; BTf=bovine transferrin)

16. In the late nineteenth century, Emil von Behring first used horse anti-diphtheria toxin antibodies to protect children from this deadly infection. This was an early example of the therapeutic use of:
   a) active immunity
   b) passive immunity
   c) adoptive immunity
   d) innate immunity

17. A forensic immunologist has immunized a sheep with purified human albumin, and would like to absorb the resulting antiserum to make it more specific for human bloodstains. In order to produce such an absorbed antiserum, he would best begin by passing it over a column bearing:
   a) whole human serum
   b) human serum albumin
   c) bovine serum albumin
   d) bovine transferrin
   e) human transferrin

18. Which of the following is the major cause of bone lesions in multiple myeloma?
   a) Presence of “M” proteins
   b) Direct destruction by myeloma cells
   c) Increased osteoclastic activity by cytokines
   d) Decreased osteoblastic activity
19. Fred Flintstone has been allotyped as G1m(2, 3); G3m(10, 11), his wife Wilma as G1m(2); G3m (6, 13) and their daughter Pebbles as G1m (2, 3); G3m (10, 13). Which of the following would be the LEAST likely phenotype for their second child?

a) G1m (2); G3m (6, 11)

b) G1m (2, 3); G3m (11, 13)

c) G1m (2, 3); G3m (6, 10)

d) G1m (2, 3); G3m (10, 13)

e) G1m (2); G3m (11, 13)

20. While studying an outbreak of Coccidiomycosis (also known as Valley Fever), you use a complement fixation assay to detect serum antibody to coccidiolin, an antigen expressed by the fungus that causes the disease. Your assay consists of a standard amount of purified coccidiolin plus fresh guinea pig serum, to which you add serial dilutions of the patients’ serum, and then add sensitized RBCs (“indicator cells”). Your results are shown in the table below:

<table>
<thead>
<tr>
<th>Patient</th>
<th>Dilution</th>
<th>Lysis with added antigen</th>
<th>Lysis with no added antigen</th>
</tr>
</thead>
<tbody>
<tr>
<td>AJ</td>
<td>1:4</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1:8</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1:16</td>
<td>–</td>
<td>+</td>
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<tr>
<td></td>
<td>1:32</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>RM</td>
<td>1:4</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>1:8</td>
<td>–</td>
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<td>1:32</td>
<td>+</td>
<td>+</td>
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<tr>
<td>LS</td>
<td>1:4</td>
<td>–</td>
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<td></td>
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<td></td>
<td>1:32</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

From these data you may conclude that:

a) Patient LS has more antibody than AJ

b) Both AJ and RM both have more antibody than LS

c) Patient AJ has more antibody than LS

d) Patients RM and LS both have more antibody than AJ

e) None of the above is a valid conclusion

21. All three complement pathways will be severely affected by a deficiency of:

a) C1

b) C2

c) C3

d) C4
22. A rabbit is immunized with DNP-BSA, its serum is collected five days later and used to isolate anti-DNP antibody by affinity purification. If this anti-DNP antibody is analyzed by equilibrium dialysis, which of the following patterns are you most likely to see?

![Diagram](image)

23. Donald and Daisy are worried about not being able to have a child, and as part of the fertility workup Donald is tested for his serum testosterone levels using ELISA. If the standard (Std) contains 350 nanograms per deciliter (ng/dL) of the hormone, Donald's level is close to:

a) 90 ng/dL  
b) 180 ng/dL  
c) 350 ng/dL  
d) 700 ng/dL  
e) 1400 ng/dL

24. If you were given a sample of a Bence-Jones protein from a particular patient, you could determine whether it was a kappa or a lambda protein by examining the amino acid sequence of the:

a) constant region  
b) variable region  
c) determining either (a) or (b) would be sufficient  
d) only knowing both (a) and (b) together would be sufficient

25. The affinity of antibodies progressively increases during the course of an immune response. This “affinity maturation” is the result of:

a) new gene rearrangements which produce higher affinity combining sites  
b) antigen-driven selection for higher affinity receptors on B-cells  
c) both  
d) neither
QUESTIONS 26-29 [2 POINTS] Choose from the following; each choice may be used once, more than once or not at all

Which part of the IgG molecule on the right is associated with:

26. _______Opsonization
27. _______Km epitopes
28. _______Ag combining site
29. _______Complement fixation

QUESTIONS 30-32: [4 POINTS] MULTIPLE CHOICE Choose the single best answer

30. Organisms which are uniformly homozygous at all genetic loci include:
   a) human identical twins
   b) inbred mice
   c) both
   d) neither

31. In the Ada and Byrt, “hot antigen suicide” experiments, the cells being killed by radioactive antigen were:
   a) proliferating B-cells
   b) non-proliferating B-cells
   c) proliferating T-cells
   d) non-proliferating T-cells
   e) macrophages

32. The major “anaphylotoxic” component(s) of complement, which increase(s) capillary permeability and contribute to the heat, redness and swelling associated with inflammation, are:
   a) C1q,r,s
   b) C3b
   c) C4b
   d) C3a, C5a
   e) C5b6789
QUESTIONS 33-36 [2 POINTS] MULTIPLE CHOICE. Choose from the following; each choice may be used once, more than once or not at all

DNA from various sources has been treated with the restriction endonuclease EcoRI, separated by electrophoresis and probed with a human C-kappa specific DNA. In the Southern blot below, which pattern is most likely to be displayed by DNA derived from:

33. _______ Waldenstrom's macroglobulinemia
34. _______ Hepatocarcinoma (liver cancer)
35. _______ Malignant melanoma (skin cancer)
36. _______ Purified B-cells from a normal human lymph node

QUESTIONS 37-41: [4 POINTS] ANSWER USING THE FOLLOWING KEY:

   a) If 1, 2 and 3 are correct
   b) If 1 and 3 are correct
   c) If 2 and 4 are correct
   d) If only 4 is correct
   e) If all are correct

37. Which of the following antibodies would be useful for paternity testing?

   1) anti-Km
   2) anti-lambda
   3) anti-Gm
   4) anti-G3

38. Immunological memory is a feature exhibited by:

   1) cell-mediated immunity
   2) adaptive immunity
   3) humoral immunity
   4) innate immunity

39. As it is secreted by a plasma cell, an IgA molecule may contain:

   1) \(\alpha\)1 heavy chain
   2) J-chain
   3) \(\kappa\) light chain
   4) S-piece
**KEY:** A. 1, 2 and 3;  B. 1 and 3;  C. 2 and 4;  D. 4 only;  E. all

40. A skin graft onto a (C57Bl6xSJL)F1 mouse will be accepted with no rejection reaction if the donor of the skin is which of the following strains? *(C57Bl/6, SJL and DBA/2 are three unrelated inbred lines of mice)*

1) C57Bl/6  
2) (DBA2xSJL)F1  
3) SJL  
4) DBA/2

41. Serum from a healthy donor of blood type A,Rh– will be able to agglutinate erythrocytes obtained from donors of which of the following types?

1) B,Rh–  
2) A,Rh+  
3) B,Rh–  
4) O,Rh–

**QUESTIONS 42-53. TRUE/FALSE [2 points] A = TRUE, B = FALSE**

42. ______ The presence of ABO incompatibility between mother and fetus increases the likelihood of developing symptoms of Rh incompatibility

43. ______ Activation of adaptive immunity is required for initiation of innate immune reactions

44. ______ Passive immunity is one example of humoral immunity

45. ______ DNP by itself is a good antigen but a poor immunogen

46. ______ Most antibodies migrate in electrophoresis as alpha-globulins

47. ______ An IgG antibody is likely to show a higher avidity for a given antigen than an IgM antibody of similar affinity

48. ______ IgG antibodies predominate in typical secondary humoral responses

49. ______ The secreted and membrane-bound forms of IgG are simultaneously produced in a given cell from the two different H-chain gene-bearing chromosomes

50. ______ The antigen combining site of an antibody will typically be made up of VL, VH, and carbohydrate
51. The Direct Coomb’s Test is typically used to detect the presence of anti-Rh antibodies in the serum of an Rh− mother.

52. All human nucleated cells express both HLA-B and HLA-DQ cell surface antigens.

53. The diversity of the TLR (Toll-Like Receptor) family is generated by DNA rearrangements different from those of the immunoglobulin genes.