### Question No. 1 of 10

**Instructions:**
1. Read the problem and answer choices carefully
2. Work the problems on paper as needed
3. Pick the answer
4. Go back to review the core concept tutorial as needed.

<table>
<thead>
<tr>
<th>Question</th>
<th>Feedback</th>
</tr>
</thead>
</table>
| **1.** Type I hypersensitivity is an immediate reaction, also known as ____.

(A) Prophylactic shock  
(B) Anaphylactic shock  
(C) Eczema  
(D) Edema  
(E) None of the above |

A. Incorrect!  
Think of another type of shock.

B. Correct!  
Type I hypersensitivity is an immediate reaction often called anaphylactic shock.

C. Incorrect!  
Eczema is a skin rash that is not immediate.

D. Incorrect!  
Edema is swelling of body tissues.

E. Incorrect!  
One of the answers is correct.

Anaphylactic shock is an immediate reaction mediated by IgE whereby binding of the antigen to antibodies on the surface of mast cells causes release of histamine and other preformed mediators and cytokines by mast cells. The resulting symptoms are blood vessel dilation, bronchial constriction and inflammation. Hay fever (seasonal allergies) and asthma are Type I responses.

**The correct answer is (B).**
### Question No. 2 of 10

**Instructions:** (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Dioxin primarily targets cells in this organ to cause immunosuppression:</td>
<td>(A) Spleen (B) Liver (C) Skin (D) Thymus (E) Bone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedback</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Incorrect! The spleen is not a target of dioxin.</td>
<td>Dioxin (TCDD) causes thymic atrophy, which interferes with the thymus’ role as the site of T cell maturation. Epithelial cells in the thymus express aryl hydrocarbon (Ah) receptors that bind TCDD and are hypothesized to underlie the specificity of dioxin-induced thymic toxicity. Dioxin has a number of other toxic effects, including the elicitation of severe, persistent acne called chloracne that appears in humans exposed to high concentrations of dioxin.</td>
</tr>
<tr>
<td>B. Incorrect! The liver is not a target of dioxin.</td>
<td>The correct answer is (D).</td>
</tr>
<tr>
<td>C. Incorrect! Although dioxin can cause chloracne, this is not considered to be the primary immunotoxic effect.</td>
<td></td>
</tr>
<tr>
<td>D. Correct! Dioxin targets the thymus.</td>
<td></td>
</tr>
<tr>
<td>E. Incorrect! Bones are not organs.</td>
<td></td>
</tr>
</tbody>
</table>
Question No. 3 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

3. The plaque-forming cell assay is used to assess the ____ immune system.
   
   (A) Humoral
   (B) Cell-mediated
   (C) Innate
   (D) Immediate
   (E) None of the above

A. Correct!
The plaque-forming cell (PFC) assay examines the humoral immune system.

B. Incorrect!
Thinks of another branch of the acquired immune system.

C. Incorrect!
Think acquired not innate, immune system activity.

D. Incorrect!
There is no "immediate" immune system.

One of the answers is correct.

Solution

Conduction of the electrical signal down the axon is aided by myelin, which acts as an insulating sheath, similar to the coating on an electrical wire. Myelin is formed by glia – in the central nervous system, it is formed by oligodendrocytes and in the peripheral nervous system, and it is formed by Schwann cells.

The correct answer is (A).
**Question No. 4 of 10**

**Instructions:** (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

4. Benzene targets the bone marrow, resulting in ____.
   
   (A) Aplastic anemia  
   (B) Hemolysis  
   (C) Type II hypersensitivity  
   (D) Autoimmune hepatitis  
   (E) None of the above

**Feedback**

A. Correct!
Benzene causes aplastic anemia by targeting the bone marrow.

B. Incorrect!
Think of an effect on the bone marrow, where new blood cells are created.

C. Incorrect!
Think of an effect on the bone marrow, where new blood cells are created.

D. Incorrect!
Autoimmune hepatitis is a rare effect associated with halothane, not benzene.

E. Incorrect!
One of the answers is correct.

**Solution**

Immunosuppression can occur from damage to primary lymphoid organs alone. For example, the organic solvent benzene targets the bone marrow, resulting in aplastic anemia, which is the inability of the body to produce new blood cells of all types. Bone marrow toxicity is observed in both humans and animals, and is hypothesized to be caused by benzene metabolism within the bone marrow, although the toxic metabolite has not yet been definitively identified.

**The correct answer is (A).**
<table>
<thead>
<tr>
<th>Question 5</th>
<th>The humoral immune system relies primarily on the ability of _____ to secrete antibodies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) B cells</td>
<td>(B) T-cytotoxic cells</td>
</tr>
<tr>
<td>(C) T-helper cells</td>
<td>(D) Macrophages</td>
</tr>
<tr>
<td>(E) Neutrophils</td>
<td></td>
</tr>
</tbody>
</table>

**Feedback**

A. Correct!  
B cells secrete antibodies.

B. Incorrect!  
T cells do not secrete antibodies.

C. Incorrect!  
T cells do not secrete antibodies.

D. Incorrect!  
Macrophages are involved in the uptake and destruction of particles, not antibody secretion.

E. Incorrect!  
Neutrophils do not make antibodies.

**Solution**

Antibodies are produced by B cells and are defined by the target with which they interact. The immune system produces a large number of antibodies in order to respond to a wide range of immune challenges that the body may or may not come in contact with at some point.

**The correct answer is (A).**
### Question No. 6 of 10

**Instructions:** (1) Read the problem and answer choices carefully  
(2) Work the problems on paper as needed  
(3) Pick the answer  
(4) Go back to review the core concept tutorial as needed.

<table>
<thead>
<tr>
<th>Question</th>
<th>6. Contact hypersensitivity is a Type ____ reaction.</th>
</tr>
</thead>
</table>
|          | (A) I  
|          | (B) II  
|          | (C) III  
|          | (D) IV  
|          | (E) None of the above  

**Feedback**

A. Incorrect!  
Type I reactions are an immediate reaction mediated by mast cells.

B. Incorrect!  
Type II reactions are cytolytic, not contact hypersensitivity.

C. Incorrect!  
Type III reactions involve formation of precipitates in blood vessels.

D. Correct!  
Contact hypersensitivity is a Type IV reaction.

E. Incorrect!  
One of the answers is correct.

**Solution**

Delayed hypersensitivity is a cell-mediated response to altered cell membranes that is mediated by T-helper and T-cytotoxic cells. Any organ can be the target of a Type IV reaction, although the skin is a common target (for example, contact hypersensitivity is often expressed as a skin disturbance, such as a rash or eczema).

**The correct answer is (D).**
### Question 7 of 10

**Instructions:** (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. The primary antibody response is mediated by _____.</td>
<td>(D) IgM</td>
</tr>
</tbody>
</table>

**Feedback**

- A. Incorrect! IgA does not mediate the primary antibody response.
- B. Incorrect! IgE does not mediate the primary antibody response.
- C. Incorrect! IgG mediates the secondary, not primary, antibody response.
- D. Correct! The primary antibody response is mediated by IgM antibodies.
- E. Incorrect! IgD does not mediate the primary antibody response.

**Solution**

The primary response to an antigen is mediated by IgM, and takes place 3 to 5 days after initial exposure. When a second exposure to the same antigen occurs, B cells undergo isotype switching, and produce IgG (rather than IgM), which is of higher affinity to the antigen and is produced at higher concentrations than IgM.

**The correct answer is (D).**
### Question No. 8 of 10

**Instructions:**
1. Read the problem and answer choices carefully
2. Work the problems on paper as needed
3. Pick the answer
4. Go back to review the core concept tutorial as needed.

<table>
<thead>
<tr>
<th></th>
<th>8. The ____ of an antibody determines its specificity to antigens.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>Variable region</td>
</tr>
<tr>
<td>(B)</td>
<td>Constant region</td>
</tr>
<tr>
<td>(C)</td>
<td>Heavy chains</td>
</tr>
<tr>
<td>(D)</td>
<td>Light chains</td>
</tr>
<tr>
<td>(E)</td>
<td>Disulfide bonds</td>
</tr>
</tbody>
</table>

**Feedback**

A. Correct!
It is variation in the variable region that allows for the large variety of antibodies produced by the body.

B. Incorrect!
The constant region of all antibodies remains constant.

C. Incorrect!
The heavy chains do not determine antigen specificity.

D. Incorrect!
The light chains do not determine antigen specificity.

E. Incorrect!
Disulfide bonds keep the antibodies together, but do not determine antigen specificity.

**Solution**

Antibodies are produced by B cells and are defined by the target with which they interact. The immune system produces a large number of antibodies in order to respond to a wide range of immune challenges that the body may or may not come in contact with at some point. Antibodies are proteins comprised of two large heavy chains and two small light chains that form a Y shape. Each antibody has a constant region and a variable region; it is the variable region that determines antibody specificity.

**The correct answer is (A).**
<table>
<thead>
<tr>
<th>Question No. 9 of 10</th>
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<tbody>
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<td><strong>Instructions:</strong> (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.</td>
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<tbody>
<tr>
<td><strong>9.</strong> In 1 out of every 35,000 exposures, halothane causes a rare autoimmune disorder called _____.</td>
<td></td>
</tr>
<tr>
<td>(A) Aplastic anemia</td>
<td></td>
</tr>
<tr>
<td>(B) Hemolysis</td>
<td></td>
</tr>
<tr>
<td>(C) Type II hypersensitivity</td>
<td></td>
</tr>
<tr>
<td>(D) Autoimmune hepatitis</td>
<td></td>
</tr>
<tr>
<td>(E) None of the above</td>
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</tbody>
</table>

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</thead>
<tbody>
<tr>
<td><strong>Feedback</strong></td>
<td></td>
</tr>
<tr>
<td>A. Incorrect!</td>
<td>Aplastic anemia is associated with benzene, not halothane.</td>
</tr>
<tr>
<td>B. Incorrect!</td>
<td>Think about an autoimmune response.</td>
</tr>
<tr>
<td>C. Incorrect!</td>
<td>Think about an autoimmune response.</td>
</tr>
<tr>
<td>D. Correct!</td>
<td>Halothane will, in rare cases, cause autoimmune hepatitis.</td>
</tr>
<tr>
<td>E. Incorrect!</td>
<td>One of the answers is correct.</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td><strong>Solution</strong></td>
<td></td>
</tr>
<tr>
<td>Halothane is a general anesthetic that is inhaled. Halothane is known to cause a rare autoimmune disease called autoimmune hepatitis, which occurs in approximately 1 out of every 35,000 exposures. The use of halothane was phased out in the 1980s as newer anesthetics became more widely used. Halothane derivatives, such as isoflurane and desflurane, have become more widely used because of their lower incidence of liver injury.</td>
<td></td>
</tr>
</tbody>
</table>

**The correct answer is (D).**
**Question No. 10 of 10**

**Instructions:** (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

<table>
<thead>
<tr>
<th>Question</th>
<th>Cannabinoid tetrahydrocannabinol (THC) not only mediates the neurological effects of marijuana, but also has this effect on the immune system.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(A) Complement activation (B) Immunosuppression (C) Arthus reactions (D) Delayed hypersensitivity (E) Eczema</td>
</tr>
</tbody>
</table>

| Feedback | A. Incorrect! Think about suppression, not stimulation, of the immune system. |
|          | B. Correct! THC is known to suppress immune function. |
|          | C. Incorrect! Arthus (Type III) reactions involve formation of precipitates in blood vessels. |
|          | D. Incorrect! Think about suppression, not stimulation, of the immune system. |
|          | E. Incorrect! Eczema is a skin rash not commonly associated with THC. |

**Solution**

THC, which is found in the *cannabis* plant (more commonly known as marijuana), is known to suppress both the humoral and cellular immune responses. THC binds to cannabinoid receptors, of which there are two sub-types: CB1 (expressed in the brain, liver and kidneys) and CB2 (which is expressed on T cells, B cells and macrophages). Activation of CB1 receptors appears to mediate the psychoactive properties of marijuana, while activation of the CB2 receptor suppresses the response to antigens that depend on T cell activity.

**The correct answer is (B).**