Part 1: General Science

Time: 11 minutes

1. What do humans and mosquitoes share in common?
- **a.** kingdom
- **b.** phylum
- **c.** genus
- **d.** species

2. Carbon-14 has a half-life of 5,730 years. How much of an 80-gram sample will remain after 17,190 years?
- **a.** 40 grams
- **b.** 20 grams
- **c.** 10 grams
- **d.** 0 grams

3. How are prokaryote cells different from eukaryote cells?
- **a.** the lack of ribosomes
- **b.** the lack of nucleus
- **c.** the lack of cell membrane
- **d.** the lack of DNA

4. What is the oxidation number for nitrate in HNO_3?
- **a.** −1
- **b.** −3
- **c.** +1
- **d.** +3

5. A trait that is only present in men and appears to be passed on only through fathers (mothers are not carriers of the trait)—what type of trait is this?
- **a.** X-linked trait
- **b.** recessive trait
- **c.** Y-linked trait
- **d.** dominant trait

6. How many electrons do the following have in their outer levels: S_2, Na, Cl, Ar, Mg_2, Al_3?
- **a.** three
- **b.** five
- **c.** seven
- **d.** eight

7. The resulting single cell from an egg fertilized by sperm is called a(n)
- **a.** monomer.
- **b.** embryo.
- **c.** fetus.
- **d.** zygote.

8. Which of the following is considered neutral on the pH scale?
- **a.** pure water
- **b.** pure saliva
- **c.** pure blood
- **d.** pure urine

9. Which organ system is responsible for producing white blood cells in humans?
- **a.** immune system
- **b.** skeletal system
- **c.** circulatory system
- **d.** integumentary system

10. A substance has the formula $MgSO_4 \cdot 7H_2O$. How many moles of water are in 3.00 moles of this substance?
- **a.** 3.00
- **b.** 7.00
- **c.** 21.0
- **d.** 30.0

11. Sodium chloride (NaCl) is formed with ionic bonds. This bond is
- **a.** a very weak bond.
- **b.** found in compounds of nonmetals.
- **c.** requires the sharing of electrons.
- **d.** the attraction of anions and cations.

12. Which adaptation differentiates mammals from other animals?
  a. body temperature regulation
  b. terrestrial mobility
  c. specialized communication
  d. giving birth to live young

13. An experiment you are conducting is difficult to start. Which of the following is NOT a probable reason for this?
  a. high activation energy
  b. low concentration of reactants
  c. it is exothermic
  d. it is endothermic

14. The bonds between amino acids in a polypeptide are
  a. glycosidic bonds.
  b. ester bonds.
  c. peptide bonds.
  d. hydrogen bonds.

15. Which of the following would be best to use in a solution in order to add sulfuric acid without changing the pH?
  a. electrolytes
  b. buffer
  c. water
  d. Bronsted-Lowery acid

16. Which is NOT an example of an endothermic change?
  a. sublimation
  b. evaporation
  c. melting
  d. condensation

17. The Earth's magnetic north pole is located closest to
  a. 0° north latitude.
  b. 90° north latitude.
  c. 90° south latitude.
  d. 0° south latitude.

18. Mammalian mothers provide nutrients to the developing embryo through the
  a. placenta.
  b. uterus.
  c. ovaries.
  d. amnion.

19. Compared to the age of the Earth, the age of the Sun is about
  a. a billion years younger.
  b. the same.
  c. a billion years older.
  d. ten billion years older.

20. The bond between oxygen and hydrogen atoms in a water molecule is a(n)
  a. ionic bond.
  b. polar covalent bond.
  c. hydrogen bond.
  d. nonpolar covalent bond.

21. The most abundant element in Earth's crust is
  a. calcium.
  b. oxygen.
  c. iron.
  d. silicon.

22. Complete the following equation:
  $NaHCO_3 + HCl \rightarrow NaCl +$
  a. CO_2
  b. H_2O
  c. HCO_3
  d. H_2CO_3

23. When calcium (Ca) gives up two electrons it becomes a(n)
  a. cation.
  b. isotope.
  c. electron donor.
  d. anion.

24. What modern organism most resembles prehistoric life from a billion years ago?
   a. algae
   b. amoeba
   c. bacteria
   d. protozoa

25. The shallow region of the ocean that is around the shorelines of continents is
   a. the oceanic plain.
   b. the oceanic sediment floor.
   c. the continental slope.
   d. the continental shelf.

Part 2: Arithmetic Reasoning

Time: 36 minutes

1. A floppy disk shows 827,036 bytes free and 629,352 bytes used. If you delete a file of size 542,159 bytes and create a new file of size 489,986 bytes, how many free bytes will the floppy disk have?
   a. 577,179
   b. 681,525
   c. 774,863
   d. 879,209

2. A train must travel to a certain town in six days. The town is 3,300 miles away. How many miles must the train average each day to reach its destination?
   a. 500 miles
   b. 525 miles
   c. 550 miles
   d. 575 miles

3. A trash container, when empty, weighs 27 pounds. If this container is filled with a load of trash that weighs 108 pounds, what is the total weight of the container and its contents?
   a. 81 pounds
   b. 135 pounds
   c. 145 pounds
   d. 185 pounds

4. Roberta takes $58 with her on a shopping trip to the mall. She spends $18 on new shoes and another $6 on lunch. How much money does she have left after these purchases?
   a. $34
   b. $40
   c. $52
   d. $24

5. A car uses 16 gallons of gas to travel 384 miles. How many miles per gallon does the car get?
   a. 22 miles per gallon
   b. 24 miles per gallon
   c. 26 miles per gallon
   d. 28 miles per gallon

6. Sofia bought a pound of vegetables and used $\frac{3}{8}$ of it to make a salad. How many ounces of vegetables are left after she makes the salad?
   a. 4 ounces
   b. 6 ounces
   c. 8 ounces
   d. 10 ounces

7. The drivers at G & G trucking must report the mileage on their trucks each week. The mileage reading of Ed's vehicle was 20,907 at the beginning of one week, and 21,053 at the end of the same week. What was the total number of miles driven by Ed that week?
   a. 46 miles
   b. 145 miles
   c. 146 miles
   d. 1,046 miles

8. A snack machine accepts only quarters. Candy bars cost 25¢, packages of peanuts cost 75¢, and cans of cola cost 50¢. How many quarters are needed to buy two candy bars, one package of peanuts, and one can of cola?

- **a.** 8 quarters
- **b.** 7 quarters
- **c.** 6 quarters
- **d.** 5 quarters

9. Dave is 46 years old, twice as old as Rajeeve. How old is Rajeeve?

- **a.** 30 years old
- **b.** 28 years old
- **c.** 23 years old
- **d.** 18 years old

10. Cheryl lives $5\frac{1}{3}$ miles from where she works. When traveling to work, she walks to a bus stop $\frac{1}{4}$ of the way to catch a bus. How many miles away from her house is the bus stop?

- **a.** $5\frac{1}{3}$ miles
- **b.** $4\frac{1}{3}$ miles
- **c.** $2\frac{1}{3}$ miles
- **d.** $1\frac{1}{3}$ miles

11. While preparing a dessert, Sue started by using 12 ounces of chocolate in her recipe. Later, she added 10 more ounces for flavor. What was the total amount of chocolate that Sue ended up using?

- **a.** 1 pound
- **b.** 1 pound 2 ounces
- **c.** 1 pound 4 ounces
- **d.** 1 pound 6 ounces

12. Write ten million, forty-three thousand, seven hundred three in numerals.

- **a.** 143,703
- **b.** 1,043,703
- **c.** 10,043,703
- **d.** 10,430,703

Use the following table to answer question 13.

STEVE'S BIRD-WATCHING PROJECT	
DAY	**NUMBER OF RAPTORS SEEN**
Monday	?
Tuesday	7
Wednesday	12
Thursday	11
Friday	4
MEAN	8

13. This table shows the data Steve collected while watching birds for one week. How many raptors did Steve see on Monday?

- **a.** 6
- **b.** 7
- **c.** 8
- **d.** 10

14. If a vehicle is driven 22 miles on Monday, 25 miles on Tuesday, and 19 miles on Wednesday, what is the average number of miles driven each day?

- **a.** 19 miles
- **b.** 21 miles
- **c.** 22 miles
- **d.** 23 miles

15. Of the 1,200 videos available for rent at a certain video store, 420 are comedies. What percent of the videos are comedies?

- **a.** $28\frac{1}{2}$%
- **b.** 30%
- **c.** 32%
- **d.** 35%

16. Darlene was hired to teach three identical math courses, which entailed being present in the classroom 48 hours altogether. At $35 per class hour, how much did Darlene earn for teaching one course?
   a. $105
   b. $560
   c. $840
   d. $1,680

17. Each sprinkler head on an athletic field sprays water at an average of 16 gallons per minute. If five sprinkler heads are flowing at the same time, how many gallons of water will be released in 10 minutes?
   a. 80 gallons
   b. 160 gallons
   c. 800 gallons
   d. 1,650 gallons

18. During the last week of track training, Shoshanna achieves the following times in seconds: 66, 57, 54, 54, 64, 59, and 59. Her three best times this week are averaged for her final score on the course. What is her final score?
   a. 57 seconds
   b. 55 seconds
   c. 59 seconds
   d. 61 seconds

19. Lefty keeps track of the length of each fish that he catches. Following are the lengths in inches of the fish that he caught one day:
   12, 13, 8, 10, 8, 9, 17
   What is the median fish length that Lefty caught that day?
   a. 8 inches
   b. 10 inches
   c. 11 inches
   d. 12 inches

20. During a fund-raiser, each of the 35 members of a group sold candy bars. If each member sold an average of six candy bars, how many total bars did the group sell?
   a. 6
   b. 41
   c. 180
   d. 210

21. If it takes two workers, working separately but at the same speed, 2 hours 40 minutes to complete a particular task, about how long will it take one worker, working at the same speed, to complete the same task alone?
   a. 1 hour 20 minutes
   b. 4 hours 40 minutes
   c. 5 hours
   d. 5 hours 20 minutes

22. A piece of gauze 3 feet 4 inches long was divided in five equal parts. How long was each part?
   a. 1 foot 2 inches
   b. 10 inches
   c. 8 inches
   d. 6 inches

23. Mr. James Rossen is just beginning a computer consulting firm and has purchased the following equipment:
   ■ three telephone sets, each costing $125
   ■ two computers, each costing $1,300
   ■ two computer monitors, each costing $950
   ■ one printer costing $600
   ■ one answering machine costing $50
   Mr. Rossen is reviewing his finances. What should he write as the total value of the equipment he has purchased so far?
   a. $3,025
   b. $5,400
   c. $5,525
   d. $6,525

24. An auditorium that holds 350 people currently has 150 seated in it. What part of the auditorium is full?

a. $\frac{1}{4}$

b. $\frac{1}{3}$

c. $\frac{3}{7}$

d. $\frac{3}{5}$

25. Mr. Richard Tupper is purchasing gifts for his family. So far he has purchased the following:

- three sweaters, each valued at $68
- one computer game valued at $75
- two bracelets, each valued at $43

Later, he returned one of the bracelets for a full refund and received a $10 rebate on the computer game. What is the total cost of the gifts after the refund and rebate?

a. $244

b. $312

c. $355

d. $365

26. While bowling in a tournament, Jake and his friends had the following scores:

- Jake, 189
- Charles and Max each scored 120
- Terry, 95

What was the total score for Jake and his friends at the tournament?

a. 404

b. 504

c. 524

d. 526

27. Alex bought 400 hot dogs for the school picnic. If they were contained in packages of eight hot dogs, how many total packages did he buy?

a. 5

b. 50

c. 500

d. 3,200

28. The city's bus system carries 1,200,000 people each day. How many people does the bus system carry each year? (one year = 365 days)

a. 3,288 people

b. 32,880 people

c. 43,800,000 people

d. 438,000,000 people

29. Department regulations require trash collection trucks to have transmission maintenance every 13,000 miles. Truck #B-17 last had maintenance on its transmission at 12,398 miles. The mileage gauge now reads 22,003. How many more miles can the truck be driven before it must be brought in for transmission maintenance?

a. 3,395 miles

b. 4,395 miles

c. 9,003 miles

d. 9,605 miles

30. Roger has completed 78% of his 200-page thesis. How many pages has he written?

a. 150

b. 156

c. 165

d. 160

Part 3: Word Knowledge

Time: 11 minutes

1. *Peripheral* most nearly means
   a. central.
   b. opinion.
   c. secondary.
   d. secret.

2. *Copious* most nearly means
   a. erratic.
   b. abundant.
   c. scarce.
   d. lax.

3. *Impartial* most nearly means
   a. hostile.
   b. prejudiced.
   c. incomplete.
   d. unbiased.

4. *Pensive* most nearly means
   a. oppressed.
   b. caged.
   c. thoughtful.
   d. worried.

5. *Predict* most nearly means
   a. foretell.
   b. decide.
   c. prevent.
   d. forget.

6. *Banish* most nearly means
   a. hate.
   b. welcome.
   c. exile.
   d. fade.

7. *Wary* most nearly means
   a. calm.
   b. curved.
   c. confused.
   d. cautious.

8. *Generic* most nearly means
   a. general.
   b. cheap.
   c. fresh.
   d. elderly.

9. *Distort* most nearly means
   a. wrong.
   b. evil.
   c. deform.
   d. harm.

10. *Solemn* most nearly means
    a. amusing.
    b. harmful.
    c. speech.
    d. serious.

11. *Negligent* most nearly means
    a. pajamas.
    b. morbid.
    c. careless.
    d. dark.

12. *Beneficial* most nearly means
    a. helpful.
    b. wise.
    c. harmful.
    d. generous.

13. *Aloof* most nearly means
    a. above.
    b. tidy.
    c. clever.
    d. reserved.

14. *Reside* most nearly means
   a. remain.
   b. home.
   c. dwell.
   d. sediment.

15. *Placid* most nearly means
   a. lazy.
   b. calm.
   c. solemn.
   d. devious.

16. *Deplete* most nearly means
   a. exhaust.
   b. erase.
   c. hurry.
   d. beg.

17. *Wretched* most nearly means
   a. twisted.
   b. forced.
   c. miserable.
   d. increased.

18. *Refute* most nearly means
   a. garbage.
   b. deny.
   c. offer.
   d. difficult.

19. *Voluntary* most nearly means
   a. willing.
   b. charity.
   c. prisoner.
   d. careless.

20. *Hinder* most nearly means
   a. lose.
   b. loose.
   c. despair.
   d. check.

21. George developed an _____ plan to earn the extra money he needed to start his own business.
   a. elitist
   b. irrational
   c. aloof
   d. ingenious

22. After an hour of heavy rain, the thunderstorm _____, and we were able to continue our golf game.
   a. abated
   b. constricted
   c. evoked
   d. germinated

23. We knew everything about the newest member of our group; she was very _____.
   a. expressive
   b. secretive
   c. reserved
   d. artistic

24. Because Mark needed to pass the exam, he made studying a _____ over watching his favorite television show.
   a. priority
   b. conformity
   c. concept
   d. necessity

25. The narrator's description was an accurate _____ of a true southern family.
   a. council
   b. portrayal
   c. disguise
   d. reunion

26. I don't trust Carl. He always acts in such
a _____ manner that I believe he is
hiding something.
a. angry
b. amicable
c. secretive
d. fervent

27. Raheeb was _____ enough to remain silent
during Angelica's tirade.
a. lax
b. prudent
c. furtive
d. happy

28. The participants in the road rally agreed
to _____ near the village commons at 5:00.
a. rendezvous
b. scatter
c. filibuster
d. disperse

29 Meeting my old friend_____ long-forgotten
memories of elementary school.
a. resigned
b. instituted
c. divulged
d. evoked

30. Muhammad fell asleep during the movie
because it had a very _____ plot.
a. monotonous
b. exciting
c. ample
d. detailed

31. *Ecstatic* most nearly means
a. inconsistent.
b. positive.
c. electrified.
d. thrilled.

32. *Prompt* most nearly means
a. slack.
b. question.
c. late.
d. punctual.

33. *Corroborate* most nearly means
a. negate.
b. confirm.
c. challenge.
d. assist.

34. *Erratic* most nearly means
a. constant.
b. simple.
c. irregular.
d. harmless.

35. *Moderate* most nearly means
a. original.
b. average.
c. final.
d. excessive.

Part 4:
Paragraph Comprehension

Time: 13 minutes

Many lives are lost every year due to drowning, and the majority of drowning victims could have been saved if they or someone nearby had only known the simple rules of water safety. The first and most important rule is to remain calm. Panic is the swimmer's worst enemy! When swimmers allow fear to overwhelm them, they stop making rational decisions and begin to *flounder*. That is the first step in drowning. When fear strikes, the swimmer must choose to remain calm and focused, thinking deliberately about how to escape the situation.

1. According to this passage, what is the first step in drowning?
    a. going underwater
    b. giving in to fear
    c. not wearing a life preserver
    d. not knowing how to swim

2. The word *flounder*, as used in this passage, most nearly means
    a. a fish.
    b. building foundation.
    c. splash about helplessly.
    d. float.

3. According to the passage, the best prevention against drowning is
    a. staying out of the water.
    b. learning how to swim.
    c. having a buddy nearby.
    d. remaining calm.

Braille is a special *tactile* form of printing used to enable blind people to read. It consists of a series of raised dots that a person can feel with the fingertips, and each letter of the alphabet is represented by one to six dots. The six dots form a rectangle if all are present, but most letters use only some of the dots. The letter *A*, for example, is one dot in the upper left corner of the rectangle.

The Braille system was actually a by-product of the Napoleonic wars of the 19th century. Napoleon wanted to devise a code that could be read at night, and a soldier invented a system of raised dots. Napoleon rejected it as too complicated, but Louis Braille simplified it for use by the blind. It is still used today.

4. Napoleon was interested in Braille because
    a. he was blind.
    b. he wanted to help the blind.
    c. he couldn't read.
    d. he wanted a code that could be read at night.

5. The word *tactile*, as used in this passage, most nearly means
    a. a sharp object.
    b. words on a printed page.
    c. something that is sticky.
    d. something that can be felt with the fingers.

6. How many raised dots are used to form each letter of the alphabet in Braille?
    a. three
    b. six
    c. from one to six
    d. none

7. What was Louis Braille's contribution to the invention of this reading system?
    a. He taught blind people how to read.
    b. He urged Napoleon to have it developed.
    c. He named it.
    d. He simplified someone else's complicated idea.

One New York publisher has estimated that 50,000 to 60,000 people in the United States want an *anthology* that includes the complete plays of William Shakespeare. What accounts for this renewed interest in Shakespeare? As scholars point out, the psychological insights that he portrays in both male and female characters are amazing even today.

8. This paragraph best supports the statement that
   a. Shakespeare's characters are more interesting than fictional characters today.
   b. people today are interested in Shakespeare's work because of the characters.
   c. academic scholars are putting together an anthology of Shakespeare's work.
   d. New Yorkers have a renewed interested in the work of Shakespeare.

9. As used in the passage, *anthology* most nearly means
   a. a collection of literature.
   b. a phrase that compares two things.
   c. the history of the human race.
   d. a television program.

People have used mechanical devices to keep track of time throughout history. The hourglass, for example, uses sand falling through a glass tube to count minutes and hours. During the 1500s, however, clock makers created a revolutionary new idea in timekeeping when they invented the pendulum clock. A pendulum is basically a long stick with a weight at the end of it that swings back and forth in a regular rhythm, powered by a spring. The pendulum moves gears inside the clock which count the seconds and minutes and hours, since the pendulum's movement is very stable and consistent. For example, a pendulum that is 10 inches long will swing back and forth once per second, making it easy for the gears to track the passage of seconds and convert them into minutes and hours.

Another major breakthrough occurred in the late 20th century with the invention of the quartz timekeeping mechanism. When electricity is passed through a small piece of quartz, the crystal *oscillates* at a very predictable rate, vibrating back and forth exactly 32,768 times per second. Modern quartz watches have a *rudimentary* computer inside, which simply counts the number of vibrations, converting the quartz crystal's movement into the passage of time. And best of all, quartz is a very common mineral and very inexpensive to work with, far less complicated than man-made mechanical pendulums.

10. Which of the following would be the best title for this passage?
   a. The Development of the Pendulum
   b. What Time Is It?
   c. Timekeeping through History
   d. The Many Uses of Quartz

11. As used in the passage, *oscillates* most nearly means
   a. opens like a clamshell.
   b. vibrates back and forth.
   c. makes a ticking noise.
   d. sits very still.

12. You can infer from this passage that
   a. quartz clocks are less expensive to make than pendulum clocks.
   b. pendulum clocks look nicer than quartz clocks.
   c. timekeeping today is more accurate than ever before.
   d. quartz clocks are waterproof.

13. As used in the passage, *rudimentary* most nearly means
   a. chewing the cud.
   b. written in runes.
   c. alien.
   d. basic.

The Fourth Amendment to the Constitution protects citizens against unreasonable searches and seizures. No search of a person's home or personal effects may be conducted without a written search warrant issued on probable cause. This means that a neutral judge must approve the factual basis justifying a search before it can be conducted.

14. This paragraph best supports the statement that the police cannot search a person's home or private papers unless they have
  a. legal authorization.
  b. direct evidence of a crime.
  c. read the person his or her constitutional rights.
  d. a reasonable belief that a crime has occurred.

15. Which of the following would be considered "probable cause" for a search warrant, according to this passage?
  a. a reasonable belief that a crime has occurred
  b. sworn testimony of the police
  c. direct evidence of a crime
  d. a judge's decision

Part 5:
Mathematics Knowledge

Time: 24 minutes

1. What is the reciprocal of $3\frac{7}{8}$?
  a. $\frac{31}{8}$
  b. $\frac{8}{31}$
  c. $\frac{8}{21}$
  d. $\frac{-31}{8}$

2. How many 12-inch square tiles are needed to tile the floor in a room that is 10 feet by 15 feet?
  a. 150
  b. 300
  c. 144
  d. 1,800

3. Express the fraction $\frac{54}{108}$ in lowest terms.
  a. $\frac{27}{54}$
  b. $\frac{9}{18}$
  c. $\frac{3}{6}$
  d. $\frac{1}{2}$

4. What is the value of the expression $\frac{xy + yz}{xy}$ when $x = 1$, $y = 3$, and $z = 6$?
  a. 3
  b. 7
  c. 12
  d. 21

5. In the equation $4p - 10 - 2p = 16$, what is p equal to?
  a. 2
  b. 6
  c. 13
  d. 26

6. If two sides of a triangle measure five and seven, between what two numbers must the length of the third side be?
  a. 2 and 5
  b. 2 and 12
  c. 5 and 7
  d. The third side can be any length.

7. What percentage of 700 is 1,225?
  a. 57%
  b. 60%
  c. 125%
  d. 175%

8. Which of the following is between $\frac{1}{3}$ and $\frac{1}{4}$?

   a. $\frac{1}{5}$

   b. $\frac{2}{3}$

   c. $\frac{2}{5}$

   d. $\frac{2}{7}$

9. Simplify: $3(6x^4)^2$.

   a. $18x^6$

   b. $18x^8$

   c. $108x^6$

   d. $108x^8$

10. To solve for an unknown in an equation, you must always

   a. add it in.

   b. subtract it.

   c. isolate it on one side.

   d. eliminate the inequality.

11. What is the area of the rectangle?
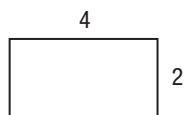
   a. 6 square units

   b. 8 square units

   c. 12 square units

   d. 16 square units

12. If reams of copy paper cost $11.39 for five cases, how much would 100 cases cost?

   a. $56.95

   b. $227.80

   c. $1,139.00

   d. $68.34

13. Which of the following is the word form of the decimal 0.08?

   a. eight hundredths

   b. eight tenths

   c. eight thousandths

   d. eight ten-thousandths

14. The product of a number and its square is 729. What is the number?

   a. 9

   b. 364.5

   c. 18

   d. 182.25

15. Which of the following is equivalent to the product of the expressions $(3x^2y)$ and $(2xy^2)$?

   a. $5x^2y^2$

   b. $5x^3y^3$

   c. $6x^2y^2$

   d. $6x^3y^3$

16. If $x - 1$ represents an odd integer, which of the following represents the next larger odd integer?

   a. $x - 3$

   b. x

   c. $x + 1$

   d. $x + 2$

17. A square television has an area of 676 square inches. How long is each side?

   a. 26 inches

   b. 25 inches

   c. 24 inches

   d. 23 inches

18. What is 42% of 6?

   a. 0.00252

   b. 0.025

   c. 2.52

   d. 0.252

19. Two ships leave from a port. Ship *A* sails west for 300 miles, and Ship *B* sails north for 400 miles. How far apart are the ships after their trips?

   a. 300 miles

   b. 400 miles

   c. 500 miles

   d. 900 miles

20. 625% converted to a mixed number equals
   a. $62\frac{1}{4}$
   b. $6\frac{1}{4}$
   c. $0.6\frac{1}{4}$
   d. 0.625

21. What is the sum of the first four prime numbers?
   a. 17
   b. 18
   c. 19
   d. 20

22. Which value of x will make this number sentence true: $x + 25 \leq 13$?
   a. −13
   b. −11
   c. 12
   d. 38

23. Which of the following numbers is NOT between −0.06 and 1.06?
   a. 0
   b. 0.06
   c. −0.16
   d. −0.016

24. What is another way to write $4.32 \times 1,000$?
   a. 432
   b. 4,320
   c. 43,200
   d. 432,000

25. Solve for x in terms of r and s: $s = 2x - r$.
   a. $x = s + r - 2$
   b. $x = 2s - r$
   c. $x = \frac{s + r}{2}$
   d. $x = \frac{2}{s + r}$

Part 6: Electronics Information

Time: 9 minutes

1. LED stands for which of the following?
   a. light emissions diagram
   b. light emitting diode
   c. lighting electrical diagram
   d. light equivalence delivery

2. Ohm's law defines which of the following?
   a. the relationship between electrons and conductors in a circuit
   b. the relationship between amperes and circuits
   c. the relationship between voltage, current, and resistance in an electrical circuit
   d. the relationship between voltage and capacitors

3. The science of electronics is
   a. the capability to link multiple electrical devices together.
   b. the process of creating electricity.
   c. the practice of using electricity in an electronic device.
   d. the use of the controlled motion of electrons through different media and vacuum.

4. A semiconductor
   a. partially blocks a battery from providing power.
   b. controls the current flowing through a circuit.
   c. controls the speed of electricity.
   d. allows electrical conductivity between a conductor and an insulator.

5. Which is NOT true of a series circuit?
  a. the current through each of the components is the same
  b. the voltage across the components is the sum of the voltages across each component
  c. a series circuit has only one resistor
  d. there is no alternative route for the charge

6. A radio receiver has which of the following electronic components?
  a. antenna, tuner, speakers, detector, amplifier
  b. antenna, detector, tuner, speakers
  c. antenna, tuner, speaker
  d. antenna, speakers, detector

7. Which of the following equations represents Ohm's Law?
  a. $\Omega = A \times C$
  b. $V = I \times R$
  c. $V = A \times C$
  d. $\Omega = V \times R$

8. What is the role of resistance in the flow of electricity?
  a. to direct the flow of electricity
  b. to stop the flow of electricity
  c. to restrict the flow of electricity
  d. to speed up the flow of electricity

9. Increasing resistance will cause
  a. the current to decrease.
  b. the voltage to increase.
  c. the current to increase.
  d. the voltage to decrease.

10. When designing a circuit, Joule's Law can be used to help
  a. determine what type of resistor to use.
  b. determine the level of voltage.
  c. ensure that the components in the circuit can handle the level of current being used.
  d. minimize the current needed.

11. Ten lightbulbs are connected in a series circuit. If one bulb breaks, what will happen?
  a. The other bulbs will still light.
  b. It depends on which bulb breaks.
  c. The other bulbs will break.
  d. The other bulbs will not light.

12. What is another name for *transistor*?
  a. semiconductor
  b. resistor
  c. circuit
  d. attenuator

13. What is the role of a capacitor?
  a. It stores electricity.
  b. It generates electricity.
  c. It burns electricity.
  d. It controls electricity.

14. When the switch is closed in this diagram, what will happen to the current?
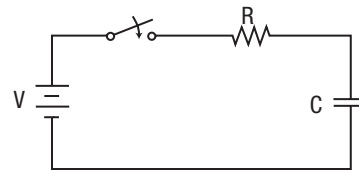
  a. The current will remain steady.
  b. The current will decrease over time as the capacitor charges.
  c. The current will increase over time as the capacitor charges.
  d. There will be no current when the switch is closed.

15. The piezoelectric effect occurs when
  a. electricity is applied to a transformer, which generates a surplus of energy.
  b. certain types of crystals are vibrated or altered, causing them to generate a voltage.
  c. static electricity builds up to a point where it discharges into the nearest object.
  d. none of the above occurs.

16. What is an RC circuit?
　　a. a response-conductor circuit
　　b. a resistance-current circuit
　　c. a response-charge circuit
　　d. a resistor-capacitor circuit

17. Which of the following schematic symbols represents an LED?

　　a.
　　b.
　　c.
　　d.
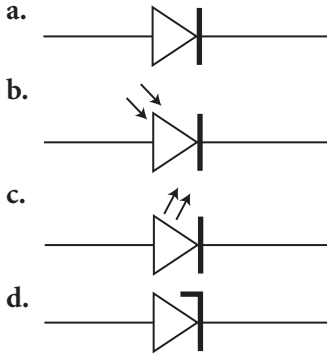
18. Transistors may come in many shapes, but all have three leads or legs, which are called the
　　a. base, activator, and collector.
　　b. base, emitter, and collector.
　　c. base, emitter, and activator.
　　d. base, collector, and tab.

19. An AA battery produces a potential difference of 1.5 V. Four AA batteries are placed in series to power a portable FM radio. What is the total voltage of the radio?
　　a. 0.75 V
　　b. 1.5 V
　　c. 3.0 V
　　d. 6.0 V

20. What is a transmitter used for?
　　a. to speed up the current in a circuit
　　b. to aid in charging the capacitor
　　c. as a resistor
　　d. as a switch or an amplifier

Part 7:
Auto and Shop Information

Time: 11 minutes

1. A typical car battery uses how many volts?
　　a. 24
　　b. 110
　　c. 12
　　d. 220

2. The following are *all* components of an automobile's engine cooling system EXCEPT the
　　a. distributor.
　　b. water pump.
　　c. thermostat.
　　d. pressure cap.

3. In the tire rating "P195/70R14," the "R" stands for
　　a. round.
　　b. radial.
　　c. rim.
　　d. rear.

4. What would happen if an automobile thermostat were stuck in the closed position?
　　a. The vehicle would run out of gas.
　　b. The engine could overheat.
　　c. The vehicle heating system would not work.
　　d. The RPM limiter would not engage.

5. Why is the sheet metal used to make fuel tanks covered with a lead-tin alloy?
　　a. to prevent excessive sloshing of fuel
　　b. to prevent static electricity buildup
　　c. to prevent rusting
　　d. to lessen vibration

6. The two general classes of lubricant are called
  a. flammable and inflammable.
  b. liquids and solids.
  c. oils and greases.
  d. natural and artificial.

7. A class c fire should be extinguished using
  a. water.
  b. carbon dioxide.
  c. all of the above.
  d. none of the above.

8. The automobile engine exhaust gas most lethal if breathed in is
  a. nitrous oxide.
  b. thermocarbons.
  c. dihydrogen monoxide.
  d. carbon monoxide.

9. When referring to an automobile, the term *camber* refers to
  a. the deflection of the headlights between high and low beam usage.
  b. the compression stroke of the cylinders.
  c. the drift of the vehicle when driving at speeds above 25 mile per hour.
  d. the outward or inward tilt of a wheel from its centerline.

10. What piece of equipment would you use to determine engine cylinder compression pressure?

  a.

  b.

  c.

  d.

11. The term *stoichiometric* refers to
  a. the ideal oil viscosity for an internal combustion engine.
  b. the ideal air-fuel mixture for an internal combustion engine.
  c. a method of measurement used by European car manufacturers.
  d. the ideal internal engine temperature for optimal operation.

12. Which of the following is a device used to reduce the toxicity of engine emissions?
  a. turbocharger
  b. fuel injector
  c. carburetor chamber
  d. catalytic converter

13. Oxyacetylene is a mixture of gases that is used in
  a. lighter-than-air craft.
  b. deep sea diving.
  c. welding.
  d. natural gas powered vehicles.

14. A saw blade that makes wide, grooved cuts so one piece of wood can fit into the groove of another is a
  a. rabbet.
  b. kerf.
  c. rip blade.
  d. dado blade.

15. Which power saw has a blade consisting of a continuous band of metal with teeth along one edge, and is used primarily for woodworking and metalworking?
  a. the jigsaw
  b. the circular saw
  c. the band saw
  d. the handsaw

16. The best tool to use if you want to make a baseball bat would be a
  a. mallet and chisel.
  b. hand saw.
  c. coping saw.
  d. lathe.

17. A plumb line is used
  a. as a vertical reference line.
  b. to fully charge an electric engine.
  c. to align horizontal pieces of wood.
  d. to transfer fuel from one tank to another.

18. Pitch, with regard to roofing, pertains to a roof's
  a. length.
  b. height.
  c. slope.
  d. width.

19. Cement, sand, gravel, and water are the primary ingredients that make up
  a. caulking.
  b. mortar.
  c. concrete.
  d. cement.

20. To remove thin strips of wood from a larger piece of wood, one would use a
  a. coping saw.
  b. plane.
  c. palm sander.
  d. mallet and chisel.

21. The following selections are *all* screw drive heads EXCEPT the
  a. plow bolt.
  b. Phillips.
  c. triple square.
  d. Robertson.

22. Which of the following would be the best tool to make a curved cut in a sheet of plywood?

a.

b.

c.

d.
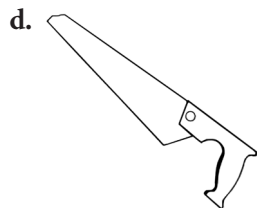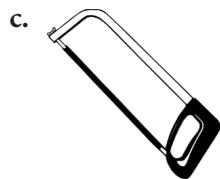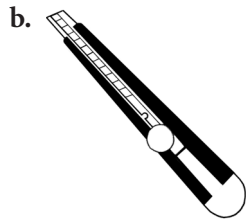
23. A length of rope 4 feet 4 inches long was divided into four equal parts. How long was each part?
   a. 8 inches
   b. 13 inches
   c. 16 inches
   d. 22 inches

24. To cut threads in metal, plastics, or similar hard material, you would use
   a. a threaded chamfer.
   b. an auger bit.
   c. tube cutters.
   d. a tap and die.

25. A builder has 27 cubic feet of concrete to pave a sidewalk whose length is 6 times its width. The concrete must be poured 6 inches deep. How long is the sidewalk?
   a. 9 feet
   b. 12 feet
   c. 15 feet
   d. 18 feet

Part 8:
Mechanical Comprehension

Time: 19 minutes
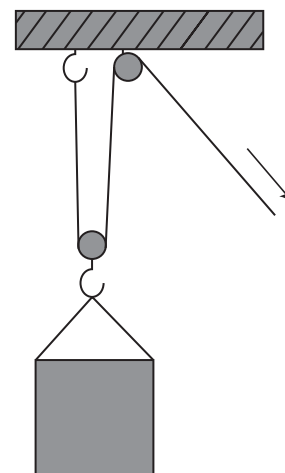
1. Using the pulley system shown here, how much force is required to lift a 276-pound load?
   a. 49 pounds
   b. 92 pounds
   c. 138 pounds
   d. 276 pounds
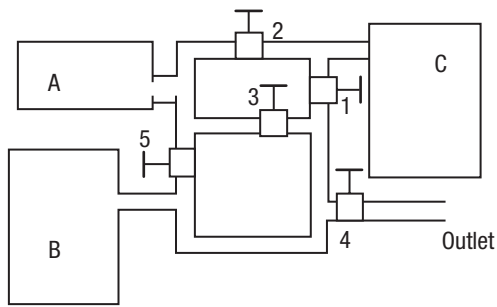
2. The water system in tank A has been contaminated. In what order can the valves be opened to empty tank A through the outlet and then refill it from tank C?
   a. open 4, then open 2
   b. open 5 and 4, then open 3
   c. open 5 and 3, then open 2
   d. open 3 and 4, then open 2

3. Ice cubes float on top of water because
   a. ice is a solid.
   b. ice is hollow.
   c. ice is denser than water.
   d. ice is less dense than water.
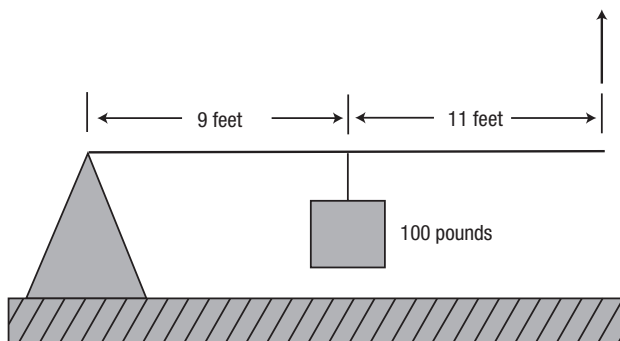
4. In the diagram shown here, Shannon wants to lift a 100-pound block using a lever. If the block is 9 feet from the pivot point and Shannon is 11 feet beyond that, how much force must she apply to lift the block?
   a. 45 pounds
   b. 99 pounds
   c. 100 pounds
   d. 109 pounds
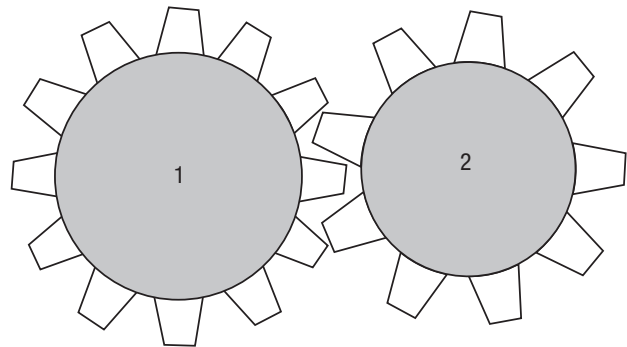
5. Gear 1 has 12 teeth and gear 2 has 9. If gear 2 turns at 60 rpm, how fast will gear 1 turn?
   a. 15 rpm
   b. 30 rpm
   c. 45 rpm
   d. 60 rpm
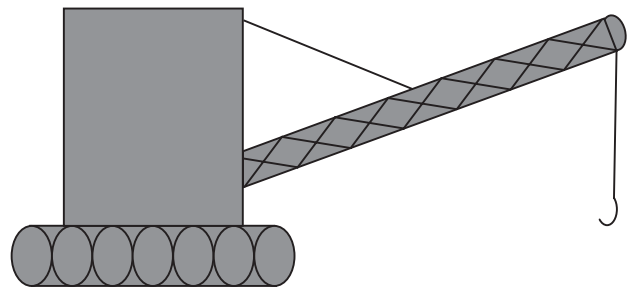
6. The arm of a crane is 16 feet long, and the cable used to lift the arm is attached 10 feet from the crane body. For the crane to lift an object weighing 600 pounds, how much force must be applied by the cable?
   a. 160 pounds
   b. 600 pounds
   c. 960 pounds
   d. 1,600 pounds

24 feet
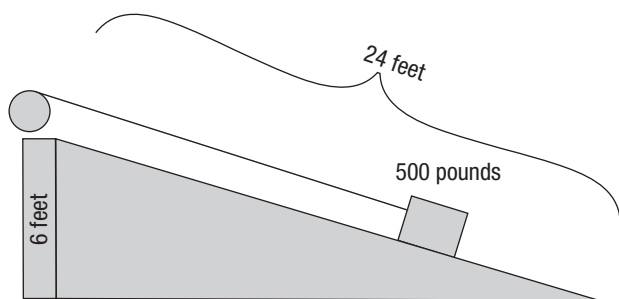
500 pounds

6 feet

7. A 500-pound block is being pulled up an incline by a pulley. The incline is 24 feet long and rises 6 feet. Neglecting friction, how much force is necessary to move the block up the incline?
   a. 125 pounds
   b. 500 pounds
   c. 144 pounds
   d. 476 pounds

8. Jill leaves her house in a car and travels north at 40 mph. Alex leaves from the same place one hour later and follows the same route at 60 mph. How long will Alex have to drive before he overtakes Jill?
   a. 40 minutes
   b. 1 hour
   c. 2 hours
   d. 3 hours
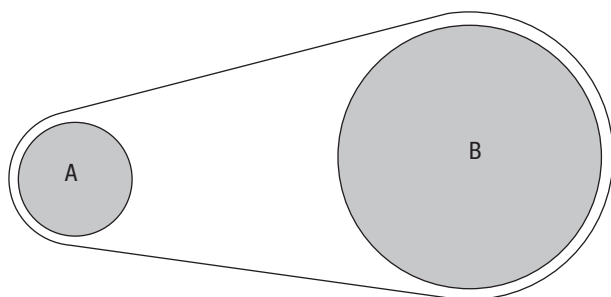
9. Pulley B has twice the circumference of pulley A. If pulley A rotates at 20 revolutions per minute (rpm), how fast must pulley B rotate?
   a. 10 rpm
   b. 20 rpm
   c. 40 rpm
   d. 200 rpm
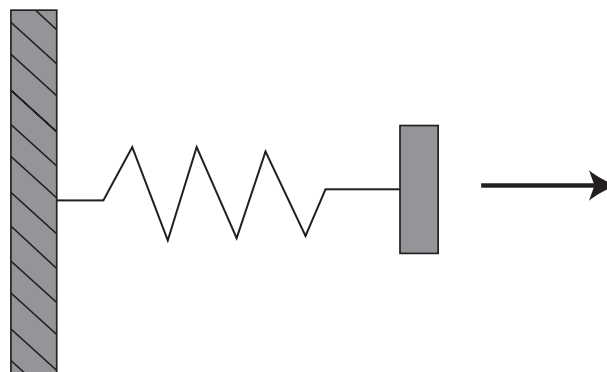
10. A spring has a force constant of 2.5 pounds per inch. How much force is required to move the spring 10 inches?
   a. 4 pounds
   b. 12.5 pounds
   c. 25 pounds
   d. 50 pounds

11. Styrofoam cups do well at keeping coffee warm because they
   a. are good insulators.
   b. are poor insulators.
   c. absorb light and convert it to heat.
   d. transfer heat from your hand to the coffee.

12. A screw has 20 threads per inch. How many full turns of the nut are required for the nut to travel 1.5 inches?
   a. 15 turns
   b. 20 turns
   c. 25 turns
   d. 30 turns

13. When oil and water are mixed together, the oil forms a layer at the top, and the water sinks to the bottom because
   a. oil is less dense than water.
   b. oil is denser than water.
   c. oil is more acidic than water.
   d. oil is less acidic than water.
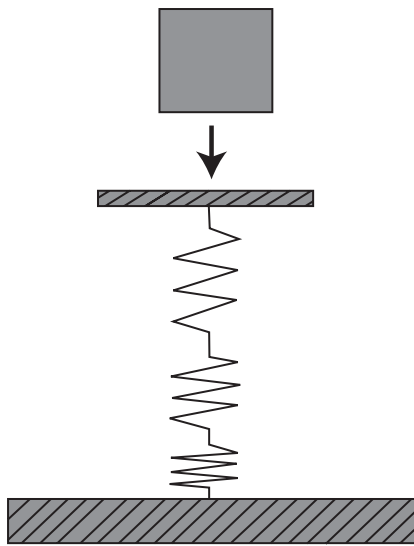
14. A series of springs with force constants of 2, 3, and 6 pounds per inch support a platform. When a 6-pound block is lowered onto it, how many inches does the platform compress?
- **a.** 4 inches
- **b.** 5 inches
- **c.** 6 inches
- **d.** 7 inches

180 pounds

4 feet — 9 feet

15. In the diagram shown here, Dave wants to lift a 180-pound block using a lever. If the block is 4 feet from the pivot point and Dave is 9 feet from the pivot point, how much force must he apply to lift the block?
- **a.** 36 pounds
- **b.** 80 pounds
- **c.** 120 pounds
- **d.** 180 pounds

16. Using the pulley system shown here, how much force is required to lift a 200-pound weight?
- **a.** 50 pounds
- **b.** 100 pounds
- **c.** 150 pounds
- **d.** 200 pounds

17. An ax is a form of what simple machine?
- **a.** a lever
- **b.** a pulley
- **c.** an inclined plane
- **d.** a gear
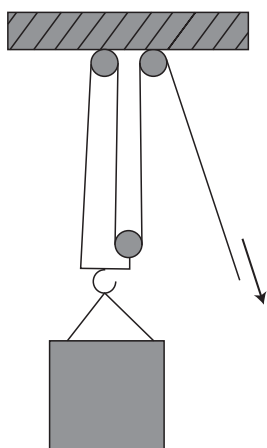
18. What is the mechanical advantage of the pulley system shown here?

a. 1
b. 2
c. 3
d. 4
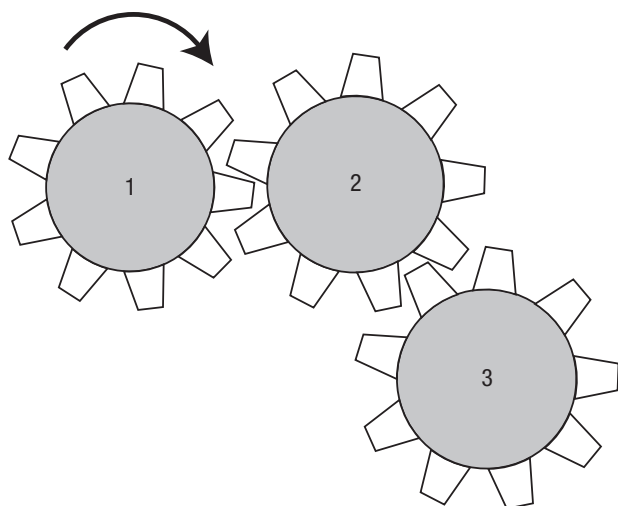
19. If gear 1 turns clockwise, which other gear(s), if any, will also turn clockwise?

a. 2 only
b. 3 only
c. 2 and 3
d. none
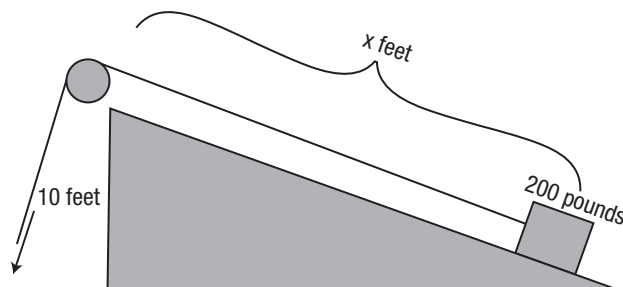
20. A 200-pound block is being pulled up an incline by a pulley. The incline rises 10 feet. Neglecting friction, if 50 pounds of force is necessary to move the block up the incline, how long is the incline?

a. 30 feet
b. 20 feet
c. 40 feet
d. 100 feet

21. A single-speed bicycle has a front chain ring with 48 teeth. The back gear has 16 teeth. If the bicycle is pedaled for 3 revolutions, how many complete revolutions will the rear wheel make?

a. 3
b. 9
c. 16
d. 48

22. What causes the pistons in an engine to move when the fuel-air mixture is ignited in the combustion chamber?

a. The heat from the explosion gives the pistons energy.
b. The high pressure created from the ignition forces the piston down.
c. Electrical energy moves the piston.
d. Momentum from the other pistons.

23. Which material would be optimal for constructing a boat anchor?
   a. wood
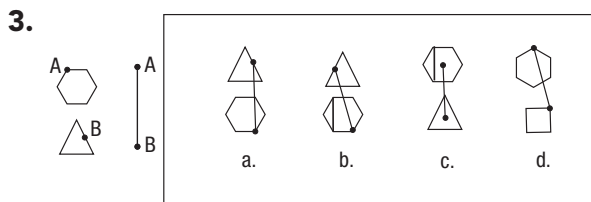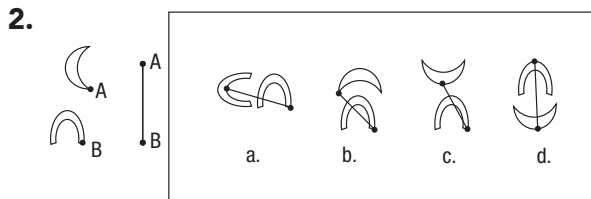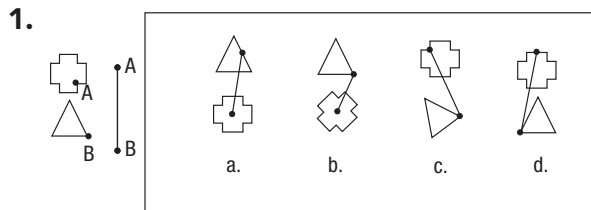   **b.** metal
   c. glass
   d. plastic
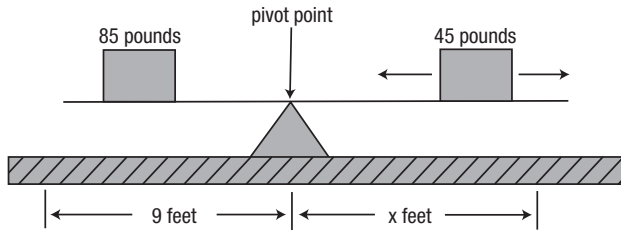
24. In the diagram, Nadine wants to balance two blocks on either side of a lever. One block weighs 85 pounds, and the other weighs 45 pounds. If the 85-pound block is 9 feet to the left of the pivot point, how far to the right of the pivot point should the 45-pound block be placed?
   a. 15 feet
   b. 9 feet
   c. 18 feet
   d. 17 feet

25. A bicycle has one front chain ring with 48 teeth and two possible gears on the back wheel: one with 16 teeth and one with 12 teeth. If the bike with the 16-tooth cog is pedaled at 80 rpm, how fast would the bike with the 12-tooth cog have to be pedaled to go the same speed?
   a. 60 rpm
   b. 80 rpm
   c. 100 rpm
   d. 120 rpm

Part 9: Assembling Objects

Time: 15 minutes

Each question is composed of five separate drawings. The problem is presented in the first drawing, and the remaining four drawings are possible solutions. Determine which of the four choices contains all of the pieces assembled properly that are shown in the first picture. Note: images are not drawn to scale.

1.

2.

3.

4.

5.

6.

A
A
B
B

a.   b.   c.   d.

7.

A
A
B
B

a.   b.   c.   d.

8.

A
A
B
B

a.   b.   c.   d.

9.

A
A
B
B

a.   b.   c.   d.

10.

A
A
B
B

a.   b.   c.   d.

11.

A
A
B
B

a.   b.   c.   d.

12.

A
A
B
B
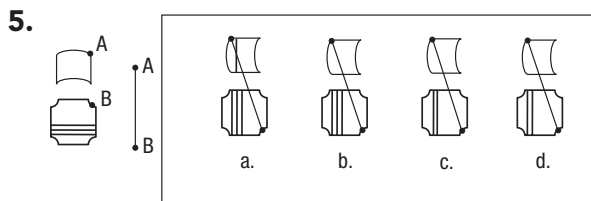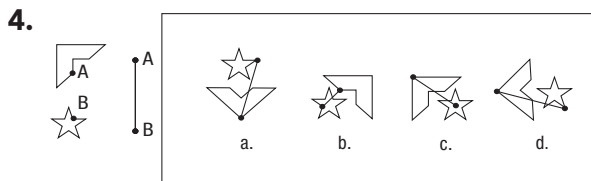
a.   b.   c.   d.

13.

a.   b.   c.   d.

14.

a.   b.   c.   d.

15.

a.   b.   c.   d.

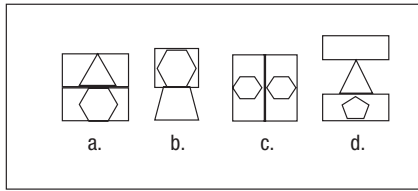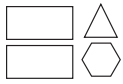**16.**

a.   b.   c.   d.

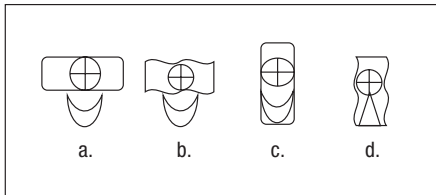**17.**

a.   b.   c.   d.

18.

a.   b.   c.   d.

19.

a.   b.   c.   d.
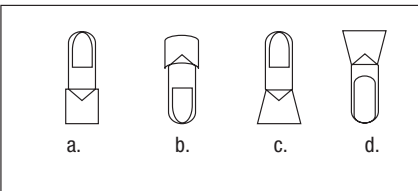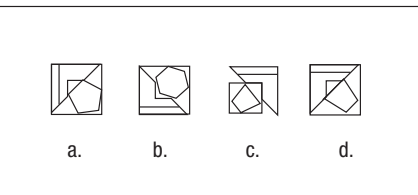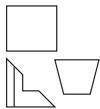
20.

21.
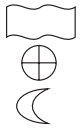
22.
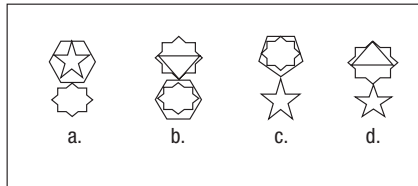
23.
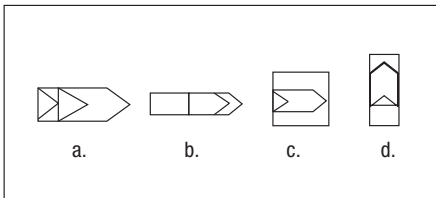
24.

25.

ANSWERS

Part 1: General Science

1. a. Humans and mosquitoes are both part of the animal kingdom. The other categories are more specific for each species.

2. c. The half-life is the time for 50% of the mass of sample to decay. In this situation three half-lives have passed so 10 grams remain.

3. b. Prokaryotes are simple, single-celled microorganisms, but contain ribosomes for protein synthesis, cell membrane, and DNA. However, they do not have a nucleus.

4. a. The hydrogen atom (H) has a +1 charge so nitrate molecule (NO_3) has a –1 charge.

5. c. Men have to have a Y chromosome, and they can only get this from their fathers. Therefore, because mothers are not carriers of the trait (they do not have the trait linked to their X chromosome) the trait must be passed on through the Y chromosome.

6. d. The atoms have complete valences because none of them has a charge. The atoms all have *p* orbitals that have a complete valence number of eight.

7. d. When fertilization takes place, the first stage of development is a single-cell zygote. Choices **b** and **c** are later stages in development; the zygote becomes an embryo, which becomes a fetus.

8. a. From the choices given, only pure water would be neutral. The other choices would be slightly basic or acidic.

9. b. Marrow produces red and white blood cells, and platelets. Marrow is located in the bones of the skeletal system.

10. c. The substance $MgSO_4 \cdot 7H_2O$ has seven molecules of water for every mole of the substance. Therefore, three moles will have 21 moles of water.

11. d. Cations of sodium are attracted to anions of chloride, which form a strong bond to make the compound NaCl.

12. a. Mammals and birds are the only animals that can regulate body temperature ("warm-blooded"). Although nearly all mammals give birth to live young, the duck-billed platypus lays eggs.

13. c. An exothermic reaction releases heat energy and is typically associated with low activation energy. Therefore, it is not expected that an exothermic reaction would be difficult to start. If the reaction has a high activation energy, low concentration of reactants, or is an endothermic reaction, it is most likely to be difficult or slow to start.

14. c. Amino acids are peptides, which form peptide bonds between them.

15. b. Sulfuric acid is a strong acid. Buffers are solutions that resist changes in pH with the addition of strong acids or bases.

16. d. Condensation is the phase change from vapor to liquid, which requires the release of energy also known as an endothermic change. The other phase changes require energy, so they are considered endothermic changes.

17. b. Latitude positions start at the equator (the midsection of the planet) and increase in magnitude until they reach 90° at the poles. The north pole is in the northern hemisphere represented by 90° north latitude.

18. a. The placenta is specialized tissue that provides nutrients to the embryo developing in the mother's uterus.

19. b. The Sun and the Earth began to form at the same time, about 4.5 billion years ago.

20. b. The bond formed between oxygen and hydrogen is a polar covalent bond, which is a relatively strong bond.

21. b. Oxygen is the most abundant element found in the Earth's crust, typically in the form of mineral oxides.

22. d. To determine the missing product figure out what elements were not used from the reactants. $NaHCO_3 + HCl \rightarrow NaCl$ shows that CO_3 and two H atoms were not used, so the missing molecule is H_2CO_3.

23. a. Cations are positively charged. With two less electrons, calcium has an excess of two protons, giving it a positive charge.

24. c. Early cells were prokaryotic and resembled bacteria found today. The other options are simple life forms, but bacteria, evolved from single cell prokaryotes, are relatively more complex.

25. d. The continental shelf starts from the continent's shore and extends out to the continental slope.

Part 2: Arithmetic Reasoning

1. d. 827,036 bytes free + 542,159 bytes freed when the document was deleted = 1,369,195 bytes; 1,369,195 bytes – 489,986 bytes put into the new file = 879,209 bytes left free.

2. c. To find the average, divide the total number of miles, 3,300, by 6 days: 3,300 miles ÷ 6 days = 550 miles per day.

3. b. This is a basic addition problem: 108 pounds + 27 pounds = 135 pounds.

4. a. To answer this question, subtract each amount of purchase from the $58 she started with; $58 – $18 = $40 and then $40 – $6 = $34. She has $34 left.

5. b. Take the total number of miles and find the average by dividing: 384 miles ÷ 16 gallons = 24 miles per gallon.

6. d. If she uses $\frac{3}{8}$ of a pound, then $\frac{5}{8}$ of a pound is left. The question asks for the number of ounces left, so convert one pound to 16 ounces. Then find $\frac{5}{8}$ of 16 ounces by multiplying: $\frac{5}{8} \times 16 = 10$ ounces.

7. c. You must subtract the reading at the beginning of the week from the reading at the end of the week: 21,053 − 20,907 = 146.

8. b. Two candy bars require two quarters; one package of peanuts requires three quarters; one can of cola requires two quarters—for a total of seven quarters.

9. c. This is a division problem: 46 ÷ 2 = 23. Rajeeve is 23 years old.

10. d. To determine $\frac{1}{4}$ of $5\frac{1}{3}$, multiply $\frac{1}{4}$ times $5\frac{1}{3}$. Change the mixed number to an improper fraction: $\frac{1}{4} \times \frac{16}{3} = \frac{16}{12} = \frac{4}{3} = 1\frac{1}{3}$.

11. d. Begin by adding: 12 ounces + 10 ounces = 22 ounces. Since this unit of measurement is not an answer choice, convert to pounds. There are 16 ounces in 1 pound, so 22 ounces is equal to 1 pound 6 ounces.

12. c. The correct answer is 10,043,703. The millions place is the third group of numbers from the right. If any group of digits *except the first* has fewer than three digits, you must add a zero at the beginning of that group.

13. a. The mean is equal to the sum of values divided by the number of values. Therefore, 8 raptors per day × 5 days = 40 raptors. The sum of the other six days is 34 raptors; 40 raptors − 34 raptors = 6 raptors.

14. c. This is a two-step problem. First, add the three numbers: 22 + 25 + 19 = 66. Now divide the sum by 3 to find the average: 66 ÷ 3 = 22.

15. d. To find what percent one number is of another, first write out an equation. Since $x\% = \frac{x}{100}$, the equation is $\frac{x}{100} = \frac{420}{1,200}$. Cross multiply: $1,200x = (420)(100)$. Simplify: $x = \frac{42,000}{1,200}$. Thus $x = 35$, which means 35% of the videos are comedies.

16. b. Take the number of classroom hours and divide by the number of courses: 48 ÷ 3 = 16 hours per course. Now multiply the number of hours taught for one course by the pay per hour: 16 × \$35 = \$560.

17. c. Multiply 16 by 5 to find out how many gallons all five sprinklers will release in one minute. Then multiply the result (80 gallons per minute) by the number of minutes (10) to get the entire amount released: 80 × 10 = 800 gallons.

18. b. Shoshanna's three best (that is, lowest) times are 54, 54, and 57, which add up to 165. Now divide to find the average of these times: 165 ÷ 3 = 55. If you got the wrong answer, you may have added all of Shoshanna's times, rather than just her best three. Even when the problem seems simple and you're in a hurry, be sure to read carefully.

19. b. The median value is the middle value in the list when the numbers are arranged in ascending or descending order. In ascending order this list becomes 8, 8, 9, 10, 12, 13, 17. The middle number is 10.

20. d. Multiply the number of members (35) by the average number of bars per person (6): 35 × 6 = 210.

21. d. It will take one worker about twice as long to complete the task, so you must multiply the original hours and minutes times two: 2 hours 40 minutes × 2 = 4 hours 80 minutes, which is equal to 5 hours 20 minutes.

22. c. First, convert feet to inches: 3 feet = 3 × 12 inches = 36 inches. Now add 4 inches: 36 inches + 4 inches = 40 inches. Then do the final operation: 40 inches ÷ 5 = 8 inches.

23. c. The total value is \$5,525. It is important to remember to include all three telephone sets (\$375 total), both computers (\$2,600 total), and both monitors (\$1,900 total) in the total value.

24. c. If 150 of the 350 seats are filled, then $\frac{150}{350}$ represents the part of the auditorium that is full. Divide each by the greatest common factor of 50 to reduce to $\frac{3}{7}$.

25. b. Add the value of the three sweaters $(3 \times 68 = 204)$, the computer game after the rebate $(75 - 10 = 65)$ and one bracelet (43); $204 + 65 + 43 = \$312$.

26. c. To find their total score, add their individual scores together: $189 + 120 + 120 + 95 = 524$. Don't forget to add 120 twice for both Charles *and* Max.

27. b. Divide the total number of hot dogs (400) by the amount in each package (8), to get the number of packages: $400 \div 8 = 50$.

28. d. This is a problem involving multiplication. The easiest way to solve this problem is to temporarily take away the five zeros, then multiply: $365 \times 12 = 4,380$. Now add back the five zeros for a total of 438,000,000. (If you selected choice **a**, you mistakenly divided when you should have multiplied.)

29. a. This is a two-step subtraction problem. First you must find out how many miles the truck has traveled since its last maintenance. To do this, subtract: $22,003 - 12,398 = 9,605$. Now subtract 9,605 from 13,000 to find out how many more miles the truck can travel before it must have another maintenance: $13,000 - 9,605 = 3,395$.

30. b. $200 \times 78 = 100x$; $x = 156$.

Part 3: Word Knowledge

1. c. *Peripheral* means of or relating to the edge, on the outer boundary; not of central importance or relevance.

2. b. *Copious* means large in number or quantity; abundant, plentiful.

3. d. *Impartial* means to be without prejudice or bias.

4. c. *Pensive* means moodily or dreamily thoughtful.

5. a. To *predict* means to declare in advance or to foretell.

6. c. To *banish* means to drive out from home or country, or to exile.

7. d. To be *wary* means to be attentive especially to danger, or to be cautious.

8. a. *Generic* means having the characteristic of a whole group, or general.

9. c. To *distort* means to twist out of the normal state, or to deform.

10. d. *Solemn* means marked by grave sobriety, or serious.

11. c. *Negligent* means neglectful, or careless.

12. a. *Beneficial* means to confer a benefit, to be advantageous or helpful.

13. d. *Aloof* means distant in feeling, or reserved.

14. c. To *reside* means to occupy a place as one's home, or to dwell.

15. b. *Placid* means free of disturbance, or calm.

16. a. *Deplete* means to reduce or deprive; exhaust means to empty completely.

17. c. *Wretched* means extremely distressed, or miserable.

18. b. To *refute* means to prove wrong, or to deny the truth of a statement.

19. a. *Voluntary* means done by one's own will, or willing.

20. d. To *hinder* means to hold back; one meaning of to *check* means to slow or bring to a stop.

21. d. *Ingenious* means marked by originality, resourcefulness, and cleverness in conception.

22. a. *Abated* means decreased in force or intensity.

23. a. An *expressive* person would be one who is open or emphatic when revealing opinions or feelings.

24. a. *Priority* means having the right to receive attention before others.

25. b. *Portrayal* means a representation or portrait.

26. c. *Secretive* means being disposed to secrecy, or to hiding things from others.

27. b. *Prudent* means careful or wise in practical affairs.

28. a. To *rendezvous* is to meet or assemble by appointment or arrangement.

29. d. *Evoked* means called up, summoned, or produced.

30. a. *Monotonous* means having a tedious sameness.

31. d. A person who is *ecstatic* is in a state of ecstasy, or thrilled.

32. d. *Prompt* means on time, or punctual.

33. b. To *corroborate* is to make certain, support, or confirm.

34. c. *Erratic* means unpredictable, uncertain, or irregular.

35. b. Something that is *moderate* is not subject to extremes, or average.

Part 4: Paragraph Comprehension

1. b. The passage states that fear leads a swimmer to stop making rational decisions, the first step in drowning.

2. c. To *flounder* in the water is to splash around helplessly.

3. d. The author does not discourage the reader from going in the water, nor does the author urge the reader to learn to swim. Having someone nearby is mentioned, but the focus of the passage is on the importance of remaining calm when trouble strikes.

4. d. Napoleon wanted to devise a code that could be read at night, and one of his soldiers invented a system of raised dots that later became Braille.

5. d. The word *tactile* refers to something that can be felt with one's hands.

6. c. The passage states that each letter of the alphabet is represented in Braille by raised dots, each letter using from one to six dots. Some letters may indeed use one dot or six, or even none—but the question asks about the alphabet as a whole, not about any individual letters.

7. d. Napoleon rejected a soldier's idea for a code that could be read at night because it was too complicated. Louis Braille took that idea and simplified it so that blind people could read.

8. b. The last sentence in the paragraph clearly supports the idea that the renewed interest in Shakespeare is due to the development of his characters. Choice **a** is incorrect because the writer never makes this type of comparison. Choice **c** is wrong, because even though scholars are mentioned in the paragraph, there is no indication that the scholars are compiling the anthology. Choice **d** is wrong because there is no support to show that most New Yorkers are interested in this work.

9. a. An *anthology* is a collection of many different pieces of literature, often spanning a historical period. An *anthology* of British poetry, for example, is a book containing a selection of poems written by British writers.

10. c. The passage discusses several mechanical timekeeping devices, including the hourglass, the pendulum clock, and the quartz watch. The information is arranged chronologically, so a title describing the history of timekeeping is most appropriate.

11. b. The word *oscillate* means to vibrate back and forth. The word is also defined in the same sentence of the passage.

12. a. The passage concludes by stating that quartz is "very inexpensive to work with" and "far less complicated" than other types of timekeeping. You might safely infer, then, that quartz clocks cost less to manufacture than traditional pendulum styles. Any of the other choices might be true, but they are not addressed in the passage.

13. d. Something that is *rudimentary* is very basic and simple.

14. a. The second and third sentence combine to give support to choice **a**. The statement stresses that there must be a judge's approval (i.e., legal authorization) before a search can be conducted. Choices **b** and **d** are wrong because it is not enough for the police to have direct evidence or a reasonable belief—a judge must authorize the search for it to be legal. Choice **c** is not mentioned in the passage.

15. c. This question refers to what the judge needs before issuing a search warrant: direct factual evidence of a crime. Neither a reasonable suspicion nor the sworn testimony of the police is enough, according to the passage. The judge's decision must be based on factual evidence.

Part 5: Mathematics Knowledge

1. b. Convert the mixed number $3\frac{7}{8}$ to the improper fraction $\frac{31}{8}$ and then invert to $\frac{8}{31}$.

2. a. Since the area of one tile is 12 inches × 12 inches = 144 square inches, which is one square foot, one tile is needed for each square foot of the floor. The square footage of the room is $10 \times 15 = 150$ square feet, so 150 tiles are needed.

3. d. Although there are other factors that 54 and 108 share, dividing both by the greatest common factor, 54, will result in the lowest terms in one step. The correct answer is $\frac{1}{2}$.

4. b. Substitute the values of each letter and simplify. The expression becomes $\frac{(1)(3) + (3)(6)}{(1)(3)}$, which simplifies to $\frac{3 + 18}{3}$ after performing multiplication. Add 3 + 18 in the numerator to get $2\frac{1}{3}$, which simplifies to 7.

5. c. First, combine like terms on the left side of the equation to get $2p - 10 = 16$. Add 10 to both sides of the equation: $2p = 26$. Divide both sides of the equation by 2: $p = 13$.

6. b. The third side must measure between the difference and the sum of the two known sides. Since $7 - 5 = 2$ and $7 + 5 = 12$, the third side must measure between 2 and 12 units.

7. d. The correct answer is 175%.

8. d. Find the answer by changing the fractions to decimals: $\frac{1}{3} = 0.333$; $\frac{1}{4} = 0.25$; $\frac{2}{7} = 0.286$. The decimal 0.286, or $\frac{2}{7}$, is between the other two.

9. d. The order of operations dictates addressing the exponents first. Then perform the operations within the parentheses. Finally, perform the operation outside the parentheses: Raising exponents by exponents is done by multiplying: $4 \times 2 = 8$; $3(36x^8)$; the correct answer is $108x^8$.

10. c. One of the most vital steps in solving for an unknown in any algebra problem is to isolate the unknown on one side of the equation.

11. b. Area is equal to base times height: $2 \times 4 = 8$ square units.

12. b. One hundred cases is five times twenty cases, so the cost is 20 times $11.39, or $227.80.

13. a. The 8 is two places to the right of the decimal point, so the correct answer is eight hundredths.

14. a. The square of a number is the number times itself. When you are looking at the answer choices, the only ones that would be possible are either choice **a** or **c**. Trial and error shows that $9 \times 9 = 81$. Then, multiply 81 by 9. The product is 729, so the correct answer is 9.

15. d. The key word *product* tells you to multiply. Therefore, multiply the coefficients of 2 and 3, and multiply the variables by adding the exponents of like bases. Keep in mind that $x = x^1$; $(3x^2y) \times (2xy^2)$ becomes $3 \times 2 \times x^2 \times x \times y \times y^2$. This simplifies to $6x^3y^3$.

16. c. Since odd integers, such as 3, 5 and 7, are two numbers apart, add 2 to the expression: $x - 1 + 2$ simplifies to $x + 1$.

17. a. Take the square root of 676 to find the length of each side; therefore, each side measures 26 inches.

18. c. The correct answer is 2.52.

19. c. Since the ships are going west and north, their paths make a 90° angle. This makes a right triangle where the legs are the distances the ships travel, and the distance between them is the hypotenuse. Using the Pythagorean theorem, $400^2 + 300^2 = distance^2$. The distance is 500 miles.

20. b. First, change the percentage to a fraction: $\frac{625}{100}$. Then, change it to a mixed number and reduce to lowest terms: $6\frac{1}{4}$.

21. a. A prime number is a number that has exactly two factors: one and itself. The first four prime numbers are 2, 3, 5, and 7. The sum of these numbers is 17.

22. a. Since the solution to the problem $x + 25 = 13$ is –12, choices **b**, **c**, and **d** are all too large to be correct.

23. c. The decimal –0.16 is less than –0.06, the smallest number in the range.

24. c. Move the decimal point four places to the right in 4.32 to get the correct answer of 43,200.

25. c. In order to solve for x, get x alone on one side of the equation. First, add r to both sides of the equation: $s + r = 2x - r + r$. The equation becomes $s + r = 2x$. Then divide each side of the equation by 2: $\frac{s+r}{2} = \frac{2x}{2}$. Cancel the 2s on the right side of the equation to get a result of $\frac{s+r}{2} = x$, which is equivalent to answer choice **c**.

Part 6: Electronics Information

1. b. LED stands for light emitting diode.

2. c. Ohm's law deals with the relationship among voltage, current, and resistance in an electrical circuit.

3. d. The science of electronics is the use of the controlled motion of electrons through different media such as a vacuum, in gaseous media, or in semiconductors.

4. d. Two important elements of an electrical device are the conductor and the insulator. A semiconductor allows electrical conductivity between these two items.

5. c. By definition, a series circuit must have more than one resistor.

6. a. The antenna captures the radio waves and transforms them, the tuner selects one of the captured signals, the detector separates the audio signal from the radio signal, the amplifier makes the audio signal loud enough to hear, and the speakers transform the audio signal to sound.

7. b. The equation for Ohm's Law is $V = I \times R$. V represents voltage, I represents current, and R represents resistance.

8. c. Resistance restricts the flow of electricity. The type of circuit (AC or DC) determines in part the direction of the flow of electricity (choice **a**). A switch (when open) will stop the flow of electricity (choice **b**).

9. b. Increasing the resistance in a circuit will cause the voltage to increase.

10. c. Joule's Law allows you to calculate the level of power in watts that is generated in a component based on the voltage in volts and the current in amps ($P = V \times I$).

11. d. In a series circuit, when one bulb no longer works, it acts as an open switch and stops all the other bulbs from working.

12. d. A transistor is a semiconductor device that amplifies a signal.

13. a. A capacitor is a passive device that stores electrical energy from a voltage source.

14. b. The resistor voltage will decrease as the capacitor voltage increases, which in turn decreases the current.

15. b. Certain types of crystals, such as quartz and Rochelle salts, are mechanically vibrated or altered, causing them to generate a voltage. Piezoelectric devices are used in a wide spectrum of consumer devices such as quartz time pieces, the autofocus mechanism in cameras, and inkjet printers where the piezoelectric effect is used to control the flow of ink from the inkjet head to the paper.

16. d. An RC circuit, or resistor-capacitor circuit, is composed of resistors and capacitors driven by a voltage or current source and can be used to filter a signal by blocking certain frequencies while allowing others.

17. c. This schematic symbol represents an LED. The other symbols represent: (**a**) a diode, (**b**) a light sensitive diode, and (**d**) a zener diode.

18. b. All transistors have a base, emitter, and collector.

19. d. Voltages in series are added to determine the total voltage. 1.5 V + 1.5 V + 1.5 V + 1.5 V = 6.0 V.

20. d. A transistor is used to switch or amplify electronic signals.

Part 7: Auto and Shop Information

1. c. A typical car battery uses 12 volts.

2. a. The distributor applies electric current in a proper sequence to spark plugs of an engine.

3. b. In tire ratings, *R* stands for radial. The *P* stands for passenger car tire.

4. b. If a thermostat were stuck in the closed position, no coolant could enter the engine cooling system, resulting in an overheating situation.

5. c. The use of the lead-tin alloy in gas tanks is to prevent rusting from water condensation inside the tank.

6. c. The two general classes of lubricant are oils and greases.

7. b. Class **c** fires are electrical fires, therefore water or other conductive agents should not be used due to the possibility of conducting electricity through the firefighting fluids. CO_2 extinguishers do not leave harmful residues and will not damage electrical equipment.

8. d. Carbon monoxide is one of a number of gaseous byproducts from an automobile engine exhaust and is the most dangerous.

9. d. Camber is the outward or inward tilt of a wheel from its centerline. It is used in the design of automobile steering and suspension.

10. c. The compressor gauge is inserted into a spark plug hole to measure cylinder pressure. The other tools in this question are all measurement tools, but cannot be used to measure engine cylinder pressure.

11. b. The ideal air-fuel mixture for an internal combustion engine is 14.7:1, known as the stoichiometric ratio.

12. d. The catalytic converter creates an environment, using precious metals and chemical reactions, where the toxic byproducts of an internal combustion engine are converted to less toxic substances.

13. c. Oxyacetylene is a combination of the gases oxygen and acetylene.

14. d. A dado blade is a set of saw blades that create a wide cutting edge for use in cutting grooves into pieces of wood.

15. c. A band saw has a blade consisting of a continuous band of metal with teeth along one edge. It used primarily for woodworking and metalworking.

16. d. You would use a lathe if you want to make your own baseball bat from a piece of wood.

17. a. A plumb line is used in conjunction with a plumb bob to determine the verticality of a specific object or point.

18. c. A roof's pitch is its degree of slope or inclination.

19. c. Cement, sand, gravel, and water are the primary ingredients in concrete.

20. b. One would use a plane to remove thin strips of wood from a larger piece of wood.

21. a. A plow bolt is an externally threaded fastener designed to pass through holes in assembled parts. It does not have a screw drive head.

22. a. A jigsaw would provide the variable movement and flexibility necessary to make a curved cut in a piece of wood.

23. b. Convert the 4 feet 4 inches into all inches (52 inches) and divide the total inches by the number of rope lengths; $\frac{52}{4} = 13$.

24. d. Taps are used to cut internal threads, similar to a nut's threads, and dies are used to cut external threads, similar to a bolt's threads.

25. d. The volume of the concrete is 27 cubic feet. Volume is length times width times depth, or (L)(W)(D), so (L)(W)(D) = 27. We're told that the length L is 6 times the width W, so L equals 6W. We're also told that the depth is 6 inches, or 0.5 feet. Substituting what we know about the length and depth into the original equation and solving for W, we get (L)(W)(D) = (6W)(W)(0.5) = 27. $3W^2 = 27$. $W^2 = 9$, so W = 3. To get the length, we remember that L equals 6W, so L equals (6)(3), or 18 feet.

Part 8: Mechanical Comprehension

1. c. The mechanical advantage of this pulley system is 2. The force required to lift the 276 pound load is 276 pounds ÷ 2 = 138 pounds.

2. d. Valves 3 and 4 allow liquid from tank A to flow to the outlet, while opening 2 provides a direct route for liquid to travel from C to A.

3. d. When water freezes into ice, it expands, meaning that it becomes less dense than water. Objects that are less dense than the fluid they are in will float.

4. a. $w_1 \times d_1 = w_2 \times d_2$. Shannon is 20 feet away from the pivot point. 100 pounds $\times$ 9 feet = 20 feet $\times w_2$. Solving for w_2 gives 45 pounds.

5. c. For every 1 rotation of gear 2, gear 1 turns 9 teeth ÷ 12 teeth = $\frac{3}{4}$ times. If gear 2 turns at 60 rpm, then gear 1 will turn at 60 rpm $\times \frac{3}{4}$ = 45 rpm.

6. c. $w_1 \times d_1 = w_2 \times d_2$. The crane shown is a special type of lever. The weight is 16 feet away from the pivot point, and the lifting cable is 10 feet from the pivot point. 600 pounds $\times$ 16 feet = 10 feet $\times w_2$. Solving for w_2 gives 960 pounds.

7. a. The mechanical advantage (MA) of a ramp is determined by the length of the ramp, l, divided by the height gained, h. In this case, MA = $\frac{l}{h}$ = 24 feet ÷ 6 feet = 4. The force required to pull a 500-pound block up a ramp is 500 pounds ÷ 4 = 125 pounds.

8. c. When Alex departs, Jill is 40 miles ahead. After 1 hour, Alex has traveled 60 miles and Jill 80 miles. After 2 hours, both Alex and Jill will have traveled 120 miles.

9. a. Since the circumference of B is twice that of A, A will have to complete 2 revolutions per 1 revolution of B. Therefore, B must rotate at 10 rpm.

10. c. The force required to stretch a spring is equal to its force constant multiplied by the distance stretch ($F = kx$). The force required to move a spring with a force constant of 2.5 pounds per inch a distance of 10 inches is 2.5 $\times$ 10 = 25 pounds.

11. a. Styrofoam is an excellent insulator, meaning that it prevents heat from flowing from the coffee to the surrounding environment. It also keeps one's hands from being burned by hot coffee.

12. d. The nut will move 1 inch down the screw every 20 turns. To travel 1.5 inches, the nut must be turned 1.5 inches $\times$ 20 turns per inch = 30 turns.

13. a. Oil is less dense than water. When two immiscible liquids of different density combine, the one that is less dense will always float to the top.

14. c. The 6-pound weight will compress the first spring: 6 pounds ÷ 2 pounds per inch = 3 inches. The second spring compresses 6 pounds ÷ 3 pounds per inch = 2 inches. The third spring compresses 6 pounds ÷ 6 pounds per inch = 1 inch. The total amount the platform compresses is therefore 3 + 2 + 1 = 6 inches.

15. b. $w_1 \times d_1 = w_2 \times d_2$. 180 pounds × 4 feet = w_2 × 9 feet. Solving for w_2 gives 80 pounds.

16. b. A pulley system of this type has a mechanical advantage of 2. So, lifting a 200-pound weight will require 200 pounds ÷ 2 = 100 pounds.

17. c. An ax head is a wedge used to split a piece of wood. It can be thought of as two ramps pressed together.

18. c. In this pulley system, the weight of the box is shared by 3 cables. So, it will have a mechanical advantage of 3.

19. b. If gear 1 turns clockwise, it will cause gear 2 to turn counterclockwise, and gear 3 will turn clockwise.

20. c. Mechanical advantage (MA) is the factor by which a simple machine multiplies for the force put into it. In this case, 50 pounds of force is used to move a 200-pound block, so MA = 200 ÷ 50 = 4. The MA of a ramp is determined by the length of the ramp, l, divided by the height gained, h. In this case, MA = $4 = \frac{l}{h} = \frac{l}{10}$ feet. Solving for l tells us the ramp is 40 feet long.

21. b. Each full turn of the pedals will turn the rear wheel 48 ÷ 16 = 3 revolutions. 3 turns of the pedals will turn the rear wheel 3 × 3 = 9 revolutions.

22. b. Combustion creates a dense, high-pressure gas that rapidly expands and pushes the piston downward.

23. b. Metal boat anchors offer the advantages of being dense and strong.

24. d. $w_1 \times d_1 = w_2 \times d_2$. 85 pounds × 9 feet = 45 pounds × d_2. Solving for d_2 gives 17 feet.

25. a. For the 16-tooth cog, the bike travels 48 ÷ 12 = 4 revolutions per pedal stroke, and 48 ÷ 16 = 3 revolutions per pedal stroke for the 12-tooth cog. At 80 turns of the pedal per minute, the bike wheel completes 80 × 3 = 240 rpm. In order to match that speed using the 12-tooth cog, one must pedal 240 rpm ÷ 4 = 60 rpm.

Part 9: Assembling Objects

1. c.
2. b.
3. a.
4. b.
5. b.
6. a.
7. d.
8. d.
9. b.
10. c.
11. c.
12. b.
13. b.
14. c.
15. a.
16. d.
17. b.
18. b.
19. c.
20. a.
21. b.
22. d.
23. c.
24. d.
25. d.

Scoring

Write your raw score (the number you got right) for each test in the blanks below. Then turn to Chapter 2 to find out how to convert these raw scores into the scores the armed services use.

1. General Science: _____ right out of 25
2. Arithmetic Reasoning: _____ right out of 30
3. Word Knowledge: _____ right out of 35
4. Paragraph Comprehension: _____ right out of 15
5. Mathematics Knowledge: _____ right out of 25
6. Electronics Information: _____ right out of 20
7. Auto and Shop Information: _____ right out of 25
8. Mechanical Comprehension: _____ right out of 25
9. Assembling Objects: _____ right out of 25