Team: _____   Score: _____ /

Names: _____ , _____

Questions marked in green are the 1st tiebreaker questions. Please box your final answer to all multi-step problems. Work shown will not count towards point total.

TIME: 25 minutes as suggested by Science Olympiad

SECTION 1: Physics (express all answers in terms of SI base units, reported to 4 significant digits), each question is worth 2 pts.

1. A boy is in a magical environment with magical gravity in which *jerk* due to gravity is constant on Planet X. Assuming the jerk due to gravity is -6 m/s/s/s, how long will it take for a ball dropped from a height of 1000 m to hit the ground?

2. An object moving in a circle of radius 10 m experiences a centripetal acceleration of 5 m/s/s. How long does it take for this object to complete one full revolution?

3. A 1.5 V battery is placed in series with a 10 ohm resistor and a 5 microfarad capacitor. How much charge is stored on the plate after 0.00004 seconds?

4. A one square foot, 5-inch thick wall separates two baths of water, one at 300 K, the other at 400 K. Given that 10 J of energy passed through the wall in 2 seconds, find the thermal conductivity of the wall.

5. How far would light travel in the time it take the capacitor in problem #3 to accumulate a charge of 2.5 microcoulombs?

SECTION 2: History of Horology, each question is worth 1 pt.

6. The first astrolabe was made in the _____ .
    A. 2nd century B.C.
    B. 5th century A.D.
   C. 8th century A.D.
    D. 13th century A.D.

7. Who is considered the inventor of the first pocket watch?
    A. Prince Asulid
    B. William Clement
    C. Peter Heinlen
    D. Su Song

8. When was the Genevan Corporation of Watchmakers founded?
    A. early 15th century
    B. early 16th century
   C. early 17th century
    D. early 18th century

9. Who built the first pendulum clock?
    A. Copernicus
    B. Galileo
    C. Huygens
    D. Heinlen

10. Who solved the problem of calculating longitude while at sea?
    A. Huygens
    B. Harrison
    C. Heinlen
    D. Henry

SECTION 3: Clock Mechanisms, each question is worth 2 pts.
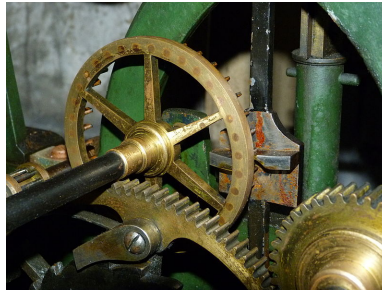
11.   What type of escapement is pictured above? _____ .

12.   Label the parts of the Duplex escapement below (1 pt per correct part):
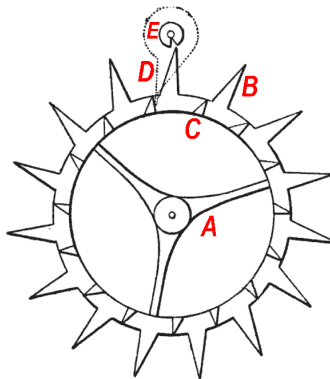
        A:

        B:

        C:

        D:

        E:

13.   Explain why clepsydras are inaccurate for measuring long periods of time.

14.   How does the mass of a pendulum bob affect its performance (in the real world)?

15.   What is one major problem with non-battery operated digital clocks?

SECTION 4: What Time is It? The value of each question is specified in parentheses.

16.   If it is 6:00 P.M. in Topeka, what time is it in Pretoria? (1) (Answer in 12-hour time)

17.   If a clock shows the time as 14:44 in Tokyo, what time is it in California? (1) (Answer in 12-hour time)

18.   If 300 days have gone by on Earth, how many days have gone by on Mercury? (2) (Answer to 4 significant digits)

19.   If 300 days have gone by on Earth, what percentage of Mercury's year has gone by? (2) (Answer to nearest percent)

20.   A 12-hour clock reads 5:22 P.M. when it is actually 6:00 P.M., and it reads 7:34 P.M. when it is actually 8:00 P.M.. At what time of day will this clock first be reading the correct time? (4) (Answer in 12-hour time)

ANSWER KEY

1. 10.00 s
2. 8.886 s
3. 4.130 x 10^-6 As
4. 0.06835 kg m s^-3 K^-1
5. 6082 m (accept answers within 5 m)
6. A
7. C
8. C
9. C
10. B
11. pinwheel escapement
12. A: escape wheel
    B: locking tooth
    C: impulse tooth
    D: pallet
    E: ruby disk
13. The rate at which water flows depends upon its viscosity, which fluctuates greatly with temperature. Small fluctuations in temperature can cause large fluctuations in accuracy.
14. A pendulum with a more massive bob will operate accurately for a longer period of time than one with a less massive bob.
15. Any power outage requires resetting; this problem does not arise with mechanical or battery-operated watches.
16. 3:00 A.M.
17. 9:44 P.M.
18. 5.111 Mercury days (units are unimportant)
19. 341%
20. 3:30 A.M.