1. Two chairs (A and B) are in an empty room overnight. Chair A is made of steel while chair B is made of wood. In the night and in the morning, the temperature of the room is 290 K. In the morning, a person chooses between Chair A and Chair B as the seat by feeling (touching) the chair and choosing one which feels warmer.

Person chooses ____(BLANK-1)____ as it feels warmer because ____ (BLANK-2)____ has ____(BLANK-3)____ ____ (BLANK-4)____ than ____ (BLANK-5)____.

(A) BLANK-1: Chair A, Chair B, neither chair
(B) BLANK-2: metal, wood, air, human body
(C) BLANK-3: higher, lower, different, same
(D) BLANK-4: heat capacity, heat conductivity, electrical resistance
(E) BLANK-5: metal, wood, air, human body

2. Consider a rope fixed at both ends under tension so that it is horizontal (i.e. assume the rope is along x-axis, with gravity acting along z-axis). Now the right end is continually oscillated at high frequency \( n \) (say \( n = 100 \text{ Hz} \)) horizontally and in a direction along the rope; amplitude of oscillation is negligible. The oscillation travels along the rope and is reflected at the left end.

Let the total length of rope be \( l \), total mass be \( m \) and the acceleration due to gravity be \( g \).

After initial phase (say a minute or so), the rope has ____(BLANK-1)____ wave, which is ____(BLANK-2)____ in nature. It results from superposition of left travelling and right travelling ____(BLANK-3)____ waves. This resulting wave has a frequency ____(BLANK-4)____ that of oscillation frequency \( n \). Simple dimensional analysis indicates that the frequency of can be of the form: ____(BLANK-5)____.

(A) BLANK-1: travelling, oscillating, stationary, regular
(B) BLANK-2: transverse, longitudinal, regular, irregular
(C) BLANK-3: transverse, longitudinal, regular, irregular
(D) BLANK-4: equal to, half, double, independent from
(E) BLANK-5: \( \sqrt{g/l} \), \( \sqrt{mg} \), \( \sqrt{mg/l} \), \( \sqrt{1/g} \)

3. When I was a child, there used to be a fair in my town during the Diwali and Id festivities. Among the many things I saw was a strange puppet show. There were three puppets, one of a man, another of a woman and the third one of a rakshasa (demon). Whenever the rakshasa was brought close to the woman, she would turn her face away. But when the man was brought close to her, she would turn back and face the man.

I and my friends looked at this show and argued for hours what caused the woman to turn her face. Choose one or more of the options below about my childhood experience above:

(A) The strange behaviour of the woman puppet was:
   1. definitely because someone was moving it with sticks or strings.
   2. definitely because there were magnets fixed in the heads of all three puppets.
   3. could be because of magnets in the heads of all three puppets or someone moving them with sticks or strings.
   4. just a random thing. Since we were children then, we thought it was happening in a particular way.

(B) If there were magnets fixed in the heads the puppets inside the head such that one end
of the magnet was at the mouth (M) and the other at the back of the head (B), then the
arrangement of the north (N) and south (S) poles of the magnets must be like:

1. man: M-N, B-S; woman: M-N, B-S; demon: M-N, B-S
2. man: M-N, B-S; woman: M-S, B-N; demon: M-S, B-N
3. man: M-S, B-N; woman: M-S, B-N; demon: M-S, B-N
4. man: M-S, B-N; woman: M-N, B-S; demon: M-S, B-N

(C) One of my friends stayed back one day at the show and kept looking at the puppets for a
long time. He asked the manager of the show to move the puppets in certain ways. The
manager as a kind person and with my friend insisting, he agreed to do what my friend
asked for. But he did not the friend if there were magnets in the puppets. But the next day,
the friend told us that he was sure that there were magnets inside the puppets’ faces. What
did he ask the manager to do and what could he have seen? He must see the effect after
asking for moving the puppets
1. backwards towards each other.
2. at different speeds.
3. up and down.
4. On the same plane, but in different directions.

4. Your teacher uses a weighing balance to take equal amounts of two substances, tartaric acid
and washing soda, say 1g. Each is dissolved separately into 100 cc of water.

(A) In 1 drop of the acid solution and 1 drop of the basic solution, we have
1. equal amount of acid and base respectively
2. equally acidic and basic substance respectively
3. acidity in one and basicity in the other are not equal
4. equal magnitude of the quantity |pH-7|

(B) Take a few cc of the acidic solution in a test-tube and mix a few drops of coloured
phenolphthaline solution ((prepared in basic medium)) into it. Which of the following may
be happening
1. The colour of the solution instantly changes pink
2. remains colourless as the colour of the added drops disappears
3. the colour diffuses through the solution and finally disappears
4. the colour diffuses through the solution and finally the entire solution acquires a faint
pink colour.

5. How many solutions are there to the equation \( x_1 + x_2 + x_3 + x_4 = 17 \), where \( x_1, x_2, x_3, x_4 \) are
nonnegative integers?
(A) 1140 .
(B) 1160 .
(C) 1040 .
(D) 1200 .

6. The function \( f(x) \) is defined as follows:
\[
f(x) = \begin{cases} 
2+x & \text{if } x \geq 0 \\
2-x & \text{if } x \leq 0
\end{cases}
\]
Then function \( f(x) \) at \( x=0 \) is:
1. continious and differentiable
2. continious but not differentiable
3. differentiable but not continious
4. neither continious nor differentiable
7. Consider a group of 20 people. If everyone shakes hands with everyone else, how many hand-shakes take place?
   1. \(^{19\text{C}_2}\).
   2. \(^{20\text{C}_2}\).
   3. \(^{20\text{C}_1}\).
   4. \(20^2\).

8. A pair of fair-dice is rolled. What is the probability that the second die lands on a higher value than the first?
   1. \(\frac{1}{36}\).
   2. \(\frac{5}{36}\).
   3. \(\frac{1}{6}\).
   4. \(\frac{5}{12}\).
   5. \(\ldots\).

9. This question is based on below graph:
   ![](image)

   Which number below represents the area of the shaded curve to the closest value.
   1. 1
   2. 1.5
   3. 2
   4. 3

10. **Papago Problem**: Tohono O’odham, formerly known as Papago, is spoken in south central Arizona in the U.S. and in northern Sonora in Mexico.

    **Match each Tohono O’odham sentence with its English translation.**
    1. Ha-cecposid ‘o g wakial g wisilo.
    2. Pi ‘ac ñeñok ‘a:cim.
    3. Ceposid ‘o g wakial g wisilo.
    4. Pi ‘o cickpan g ceoj.
    5. Pi ‘o ciposid g wakial g wisilo.
    7. Ñeok ‘o g ceoj.
    8. Ñeok ‘añ ‘añi.
    A. I am speaking
    B. The man is speaking.
    C. I am working.
    D. The cowboys aren’t branding the calf.
    E. We are not speaking.
    F. The men are working.
    G. The cowboy is branding the calf.
    H. The cowboy is branding the calves.
    I. The men are not working.
11. Given below is an encrypted sentence.
   SJ HVJ HMM GPVC BHI. LPBJ VJBHEC LP. - LHBZJM GJFAJXX
   Decode it based on the clues given below.
   Clue-1: H stands for A
   Clue-2: stands for E
   Clue-3: C stands for N
   Clue-4: L stands for S
   Clue-5: I stands for D

   (A) The word GPVC is decoded as __________
   1. fern
   2. born
   3. moan
   4. burn

   (B) The word HVJ is decoded as __________
   1. pie
   2. lie
   3. die
   4. are

   (C) The word LPBJ is decoded as __________
   1. some
   2. sore
   3. sole
   4. site

J. The cowboy is not branding the calf.
12. Swahili, a Bantu language, is spoken in the southern of Africa and along east coast of Africa. The following are certain dates in Swahili given along with their English translations in a random order. Match the Swahili dates to the correct English translations:

<table>
<thead>
<tr>
<th>Swahili Dates:</th>
<th>English translations in random order:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. tarehe tatu Disemba jumamosi</td>
<td>A. Monday, October 5th</td>
</tr>
<tr>
<td>2. tarehe tano Oktoba jumapili</td>
<td>B. Tuesday, April 2nd</td>
</tr>
<tr>
<td>3. tarehe pili Aprili jumanne</td>
<td>C. Wednesday, October 5th</td>
</tr>
<tr>
<td>4. tarehe tano Oktoba jumatatu</td>
<td>D. Tuesday, April 4th</td>
</tr>
<tr>
<td>5. tarehe nne Aprili jumanne</td>
<td>E. Sunday, October 5th</td>
</tr>
<tr>
<td>6. tarehe tano Oktoba jumatano</td>
<td>F. Saturday, December 3rd</td>
</tr>
<tr>
<td></td>
<td>G. Sunday, December 3rd</td>
</tr>
<tr>
<td></td>
<td>H. Saturday, July 1st</td>
</tr>
</tbody>
</table>

Now, translate the following into Swahili using the given words:

<table>
<thead>
<tr>
<th>tatu</th>
<th>tarehe</th>
<th>pili</th>
<th>jumatano</th>
<th>jumapili</th>
<th>Disemba</th>
<th>tarehe</th>
<th>Aprili</th>
</tr>
</thead>
</table>

(A) Wednesday, April 3rd: ___ ___ ___ ___

(B) Sunday, December 2nd: ___ ___ ___ ___