TE 2. Unit 9.1. Measuring Devices. Surname Name Group

Task 1. **Match each device to its primary operating principle or defining feature.**

Column A – Device	Column B – Principle / Feature
1. Thermocouple	A. Uses a turbine rotated by fluid flow
2. Manometer	B. Converts strain into change in electrical resistance or capacitance
3. Turbine flow meter	C. Two dissimilar metals generate voltage proportional to temperature
4. Pressure transducer	D. Measures temperature via electrical resistance change in a metal wire
5. RTD (Resistance Temperature Detector)	E. U-shaped tube with liquid to show pressure difference

Task 2. **Find 11 terms in the puzzle, then write the correct one-word answer for each clue below.**

E	B	V	J	K	Z	R	A	N	G	E	T	H	D	B
L	Y	V	V	U	X	P	R	E	S	S	U	R	E	D
P	Z	I	B	N	K	C	H	W	V	I	Y	Y	I	T
D	D	N	R	F	C	G	Z	U	O	F	Q	E	W	H
O	C	F	G	M	O	P	T	L	T	U	A	R	C	B
E	L	Y	Z	N	O	J	F	M	K	I	V	A	R	R
M	B	D	P	V	G	G	D	A	X	Z	E	E	Z	M
M	N	K	Q	Q	C	G	D	A	A	X	Z	E	Z	A
O	R	I	M	I	E	R	J	C	Q	U	R	B	O	B
F	D	I	A	P	H	R	A	G	M	J	J	C	O	O
H	U	F	W	X	M	M	I	Z	U	A	E	J	E	E
G	R	J	F	L	C	V	F	J	I	X	H	K	K	T
U	S	G	D	Y	T	N	S	O	K	Y	E	Z	E	R
U	S	G	D	D	Y	T	N	S	O	K	Y	E	Z	R

WORD LIST

ACCURACY
CALIBRATION
DIAPHRAGM
DRIFT
FLOW
MANOMETER
PRESSURE
RANDOM
RANGE
THERMOCOUPLE
ULTRASONIC

1. Two different metals joined together produce a voltage that changes with temperature
2. Gradual loss of accuracy over time
3. Force exerted per unit area
4. Process of checking a device against a known standard
5. U-shaped tube filled with liquid; measures pressure difference
6. Rate at which fluid moves through a pipe or channel

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7. Type of flow meter that uses sound waves
8. Minimum and maximum values a device can measure
9. Error that is unpredictable and varies each time
10. A flexible metal disk that deflects when pressure is applied

Task 3. Mark each statement as True (T) or False (F).

1. A magnetic flow meter works well with non-conductive liquids like oil.
2. Infrared thermometers must physically touch the object to measure its temperature.
3. Calibration can correct systematic errors but cannot completely eliminate random errors.
4. A data logger with a 1-second sampling interval records 3,600 measurements in one hour.
5. A device can be accurate (close to the true value) but not precise.
6. Thermocouples are suitable for cryogenic temperatures near absolute zero.
7. A Bourdon tube gauge is a type of electronic pressure transducer.
8. Measurement uncertainty means the measurement is useless.

Task 4. Read the text and fill in the gaps with the correct word from a word bank.

TURBINE FLOW METER, RTD, AND DIAPHRAGM GAUGE

sensitive, limited, rotation, clean, disk, increases, damaged, turbine, low, accurate, resistance

A turbine flow meter contains a small [1] _____ (propeller) inside the pipe. As fluid flows past, the turbine rotates. The [2] _____ speed of the turbine is proportional to the flow rate. These meters are accurate and reliable for [3] _____ fluids like clean water or oil. However, they can be [4] _____ by solid particles in the fluid.

An RTD measures temperature by detecting changes in the electrical [5] _____ of a metal wire. As temperature increases, the resistance [6] _____ in a predictable way. RTDs are very [7] _____ and reliable. They are commonly used in pharmaceutical and food production facilities. However, they have a [8] _____ temperature range (typically –200°C to 850°C) and a slower response time than thermocouples.

A diaphragm gauge uses a flexible metal [9] _____ that deflects when pressure is applied. This deflection moves a pointer on a dial to show the pressure reading. Diaphragm gauges are especially good for measuring [10] _____ pressures. They are [11] _____ and accurate. However, they can be damaged by overpressure or corrosive fluids.

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Task 5. For each scenario, select the most appropriate device from the list.

Device options:
A – Thermocouple
B – Infrared thermometer
C – Digital thermometer (contact probe)
D – RTD
E – Manometer
F – Turbine flow meter
G – Magnetic flow meter
H – Data logger with thermocouple input
I – Ultrasonic flow meter
J – Liquid-in-glass thermometer

Scenario	Best device
1. Measuring low pressure difference across a filter in a lab (very low pressure, high accuracy needed)	
2. Recording temperature inside a freezer truck every 5 minutes for 7 days	
3. Measuring flow of dirty wastewater containing metal particles	
4. Measuring temperature of a furnace interior at 1,600°C	
5. Quick check of a hot motor surface without stopping the machine	
6. Simple, low-cost measurement of water temperature in a school lab (single reading)	
7. Measuring natural gas flow in a pipeline – no contact with gas, high cost acceptable	

Task 6. Listen to the text and fill in the gaps with the correct word.

1. A manometer is an instrument used to measure _____ in fluids such as gases and liquids.
2. A manometer consists of a _____tube partially filled with a liquid
3. When pressure is applied, the _____ moves, creating a difference in_____ between two columns.
4. The differential manometer is used to measure the pressure difference between two _____ in a system, which is especially important in _____ analysis and fluid dynamics.
5. Manometers are valued for their accuracy and reliability because they do not rely on _____ mechanical parts.
6. Manometers are commonly used in HVAC systems, pipeline monitoring, and _____ experiments.

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Calibration.

Circle or select the best answer.

1. What is calibration?
a) Replacing a broken sensor
b) Checking and adjusting a device against a known standard
c) Cleaning a measurement device
d) Installing a new thermometer

2. Why do measurement devices need regular calibration?
a) They become more expensive over time
b) They stop working completely
c) They change color with use
d) They drift and become less accurate

3. What is a common reference standard for temperature calibration?
a) Boiling oil
b) Room temperature air
c) Ice point (0°C) and boiling point (100°C) of water
d) Human body temperature

4. What happens during calibration?
a) The device is compared to a standard and adjusted if needed
b) The device is thrown away
c) The device is painted with new labels
d) The device is used continuously for 24 hours

5. How often should devices be calibrated?
a) Never – once calibrated, they stay accurate forever
b) Every day for all devices
c) Depends on device type, usage, and industry requirements
d) Only when they break

6. What is a calibration certificate?
a) A warranty for the device
b) A document that proves the device was calibrated and documents its accuracy
c) An instruction manual for using the device
d) A receipt for purchasing the device

7. What does "drift" mean in measurement?
a) The device moves from its position
b) Gradual loss of accuracy over time
c) The device becomes faster
d) The device changes color

8. Which of the following is NOT a benefit of calibration?
a) Ensures measurements are accurate and trustworthy
b) Meets industry standards and regulations
c) Prevents costly errors from inaccurate data
d) Makes the device more expensive

9. What is a "standard" in calibration?
a) A cheap replacement part
b) A known reference used during calibration
c) A type of thermometer
d) A calibration certificate

10. Which industry would require the most frequent calibration?
a) Pharmaceutical production (strict safety and dosage control)
b) Automotive manufacturing (mechanical tolerances important)
c) Food processing plant (temperature and hygiene critical)
d) HVAC maintenance services (comfort-level measurements)

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