Technical reasoning: applied practice: open practice pack

20 untimed questions across 4 authored sections.

Detail	Value
Pack	applied-practice-technical-reasoning
Source	applied-practice
Pack version	v1
Worksheet items	20
Authored hints	0
Worked explanations	20

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Learner worksheet

Each item gives you a tool, a drawing convention, a specification, or a symptom, and asks what follows from it. The skill under test is disciplined inference, reading exactly what the evidence says and no more, rather than trade knowledge. Nothing here is timed.

Choose one answer for each item. On a judgement item, more than one option is often defensible. Pick the one you would rate most effective, then check the worked explanation for why the runner-up is weaker.

Tools, fasteners, and measurement

Begin with the vocabulary of technical work: choosing an instrument that can actually resolve the quantity you need, and reading a fastener or a tolerance correctly.

1. technical-reasoning-applied-s01-q01

You need to measure the outside diameter of a shaft to within about 0.02 mm. Which instrument is appropriate?

- A. A steel rule
- B. A tape measure
- C. A try square
- D. A vernier caliper

Your answer: _____

2. technical-reasoning-applied-s01-q02

What is a torque wrench for?

- A. Releasing seized fasteners with extra leverage

- B. Tightening a fastener to a specified torque so the clamping force is correct and repeatable
- C. Measuring the length of a bolt before fitting
- D. Cutting a new thread in a blind hole

Your answer: _____

3. technical-reasoning-applied-s01-q03

A fastener is specified as M10 x 1.5. What does the 1.5 refer to?

- A. The bolt's length in centimetres
- B. A strength grade of 1.5 times standard
- C. The thread pitch: the distance between adjacent crests, in millimetres
- D. The across-flats size of the head

Your answer: _____

4. technical-reasoning-applied-s01-q04

Why is a plain washer fitted under a nut on a soft or oversized-hole joint?

- A. It spreads the clamping load over a larger area and protects the surface finish
- B. It increases the effective thread pitch
- C. It prevents corrosion along the bolt shank
- D. It lubricates the thread so less torque is needed

Your answer: _____

5. technical-reasoning-applied-s01-q05

A drawing calls for a hole of 20.00 mm with a tolerance of plus 0.05 mm and minus 0.00 mm. Which measured hole is within tolerance?

- A. 19.98 mm
- B. 20.03 mm
- C. 20.07 mm
- D. 19.95 mm

Your answer: _____

Drawings and specifications

Read a drawing or a written specification for exactly what it states. A specification is met at its stated duty point, not on average.

6. technical-reasoning-applied-s02-q01

On an engineering drawing, a dimension shown in round brackets, such as (150), is:

- A. A maximum permitted value
- B. A minimum permitted value
- C. A reference dimension, given for information and not to be worked or inspected to
- D. A conversion from imperial units

Your answer: _____

7. technical-reasoning-applied-s02-q02

A drawing is marked 'SCALE 1:5'. A feature measures 40 mm on the printed sheet. What is its real size?

- A. 200 mm
- B. 8 mm
- C. 45 mm
- D. 35 mm

Your answer: _____

8. technical-reasoning-applied-s02-q03

On an orthographic drawing, an edge hidden behind the material is drawn as:

- A. A long-dash short-dash chain line
- B. A thick continuous line
- C. A freehand wavy line
- D. A line of short evenly spaced dashes

Your answer: _____

9. technical-reasoning-applied-s02-q04

A drawing is in third-angle projection. Where is the view taken from the right-hand side of the object placed?

- A. To the left of the front view
- B. To the right of the front view
- C. Directly above the front view
- D. Directly below the front view

Your answer: _____

10. technical-reasoning-applied-s02-q05

A specification requires a pump to deliver 'not less than 40 litres per minute at 3 bar'. A candidate pump is rated 38 L/min at 3 bar and 45 L/min at 2 bar. What follows?

- A. It meets the specification, because 45 exceeds 40
- B. It meets the specification on average across its range
- C. Nothing can be determined without the motor rating
- D. It does not meet the specification: at the stated duty point it delivers only 38 L/min

Your answer: _____

Systems thinking and fault isolation

Move from a symptom to the smallest set of possible causes. Notice which observations already rule something out before you test anything.

11. technical-reasoning-applied-s03-q01

A conveyor stops. The motor hums audibly and gets warm, but the belt does not move. What should be checked first?

- A. Whether the drive train is jammed or a coupling has failed, since the motor is clearly receiving power
- B. Whether the motor needs replacing

- C. Whether the supply fuse has blown
- D. Whether the controller program has been corrupted

Your answer: _____

12. technical-reasoning-applied-s03-q02

What does the half-split method of fault-finding achieve?

- A. It tests the cheapest components first
- B. It tests the historically most likely component first
- C. It avoids having to dismantle anything
- D. Each test eliminates half of the remaining suspect area, so the fault is located in far fewer tests

Your answer: _____

13. technical-reasoning-applied-s03-q03

On a running hydraulic system, the pressure gauge reads zero, yet the ram extends and lifts its normal load. What is the most likely explanation?

- A. The pump has failed
- B. The gauge or its isolating valve is at fault, because the ram lifting its load proves pressure exists
- C. The relief valve is set too high
- D. The reservoir has been overfilled

Your answer: _____

14. technical-reasoning-applied-s03-q04

A machine works perfectly from cold and develops an intermittent fault only after an hour of running. What class of cause does that pattern point to?

- A. A software defect in the control program
- B. An incorrectly rated supply fuse
- C. Something whose behaviour changes with temperature, such as a loose terminal expanding or a marginal component drifting
- D. Operator error during start-up

Your answer: _____

15. technical-reasoning-applied-s03-q05

A repair has been made and the machine now runs. What is the correct final step?

- A. Re-test under the conditions that produced the fault, confirm the symptom is gone, and record what was found and done
- B. Return the machine to service immediately to recover lost output
- C. Replace the neighbouring components as a precaution
- D. Clear the fault counter so the log starts clean

Your answer: _____

Maintenance, fits, and materials

Close with the judgements that keep equipment working: when to intervene, how parts are meant to fit, and how materials behave together.

16. technical-reasoning-applied-s04-q01

What is the principal advantage of planned preventive maintenance over run-to-failure?

- A. It always costs less in parts over the life of the machine
- B. The work happens at a chosen time, which reduces unplanned downtime and the consequential damage a failure causes
- C. It removes the need to hold spare parts
- D. It eliminates failures entirely

Your answer: _____

17. technical-reasoning-applied-s04-q02

A shaft measures 24.98 mm and the bore it enters measures 25.02 mm. What kind of fit is this?

- A. An interference fit
- B. A transition fit
- C. A clearance fit
- D. No fit is possible

Your answer: _____

18. technical-reasoning-applied-s04-q03

Why is a lubricant specified by a viscosity grade rather than simply as 'oil'?

- A. Viscosity decides whether a film thick enough to separate the surfaces survives at the operating temperature and load
- B. It is a purchasing convention with no functional meaning
- C. A higher grade is always better for every application
- D. It identifies the dye colour so oils are not mixed

Your answer: _____

19. technical-reasoning-applied-s04-q04

An aluminium bracket is bolted directly to stainless steel in a damp outdoor location. What should be expected, and what is the usual control?

- A. The stainless steel corrodes first, so it is painted
- B. Neither corrodes provided both surfaces are clean
- C. Corrosion is prevented by painting the stainless steel only
- D. The aluminium corrodes preferentially at the joint, so the two metals are separated by an insulating washer or coating

Your answer: _____

20. technical-reasoning-applied-s04-q05

A rolling bearing runs hot and noisy within minutes of being replaced, having been quiet before the old one failed. What is the most likely cause?

- A. Normal running-in, which will settle within a few hours
- B. The shaft speed is now too low for the bearing
- C. It was fitted with the wrong preload, or the housing and shaft are misaligned
- D. The housing has been painted on the outside

Your answer: _____

Authored hints

This applied practice source does not publish separate authored hints: the rationale is attached to each item as a worked explanation instead. Every item is therefore listed as missing a hint, and no hint text is generated or inferred.

20 worksheet items do not have an authored hint. No hint text was generated for them.

Answer key

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Technical reasoning: applied practice: open practice pack answer key

Item	Choice	Answer
technical-reasoning-applied-s01-q01	D	A vernier caliper
technical-reasoning-applied-s01-q02	B	Tightening a fastener to a specified torque so the clamping force is correct and repeatable
technical-reasoning-applied-s01-q03	C	The thread pitch: the distance between adjacent crests, in millimetres
technical-reasoning-applied-s01-q04	A	It spreads the clamping load over a larger area and protects the surface finish
technical-reasoning-applied-s01-q05	B	20.03 mm
technical-reasoning-applied-s02-q01	C	A reference dimension, given for information and not to be worked or inspected to
technical-reasoning-applied-s02-q02	A	200 mm
technical-reasoning-applied-s02-q03	D	A line of short evenly spaced dashes
technical-reasoning-applied-s02-q04	B	To the right of the front view
technical-reasoning-applied-s02-q05	D	It does not meet the specification: at the stated duty point it delivers only 38 L/min
technical-reasoning-applied-s03-q01	A	Whether the drive train is jammed or a coupling has failed, since the motor is clearly receiving power
technical-reasoning-applied-s03-q02	D	Each test eliminates half of the remaining suspect area, so the fault is located in far fewer tests
technical-reasoning-applied-s03-q03	B	The gauge or its isolating valve is at fault, because the ram lifting its load proves pressure exists

technical-reasoning-applied-s03-q04	C	Something whose behaviour changes with temperature, such as a loose terminal expanding or a marginal component drifting
technical-reasoning-applied-s03-q05	A	Re-test under the conditions that produced the fault, confirm the symptom is gone, and record what was found and done
technical-reasoning-applied-s04-q01	B	The work happens at a chosen time, which reduces unplanned downtime and the consequential damage a failure causes
technical-reasoning-applied-s04-q02	C	A clearance fit
technical-reasoning-applied-s04-q03	A	Viscosity decides whether a film thick enough to separate the surfaces survives at the operating temperature and load
technical-reasoning-applied-s04-q04	D	The aluminium corrodes preferentially at the joint, so the two metals are separated by an insulating washer or coating
technical-reasoning-applied-s04-q05	C	It was fitted with the wrong preload, or the housing and shaft are misaligned

Worked explanations

technical-reasoning-applied-s01-q01: A vernier caliper resolves to roughly 0.02 mm and grips the diameter squarely. A steel rule is the plausible alternative, but its finest division is about 0.5 mm, so it cannot resolve the tolerance the question asks for however carefully it is read.

technical-reasoning-applied-s01-q02: The point is a controlled clamping force: too little and the joint loosens, too much and the bolt yields or the flange distorts. Using one to break seized fasteners is common and wrong: the shock loading damages the calibrated mechanism.

technical-reasoning-applied-s01-q03: In an ISO metric designation the first figure is the nominal major diameter and the second is the pitch, so an M10 x 1.5 nut will not run onto an M10 x 1.25 stud. Head size is not part of the thread designation at all, though it is easy to assume it must be.

technical-reasoning-applied-s01-q04: A washer distributes the bearing pressure so the nut does not sink into soft material or pull through an oversized hole, and it gives a clean surface for the nut to turn against. It has no effect on thread geometry, and a plain washer is not a lubricant or a corrosion barrier.

technical-reasoning-applied-s01-q05: The permitted range runs from 20.00 mm to 20.05 mm, so only 20.03 mm qualifies. 19.98 mm is the trap: it is closer to nominal than 20.03 mm, but the tolerance is one-sided and undersize is not allowed at all.

technical-reasoning-applied-s02-q01: A bracketed dimension is derived from other dimensions on the drawing and is repeated only as a convenience, so it carries no tolerance and is never the one to machine to. Treating it as a limit is exactly the error the convention exists to prevent.

technical-reasoning-applied-s02-q02: 1:5 means one unit on the drawing represents five on the object, so 40 x 5 = 200 mm. The 8 mm answer inverts the ratio, which would be 5:1, an enlargement used for small parts.

technical-reasoning-applied-s02-q03: Short dashes mean a hidden detail; a chain line means a centre line or axis, and a wavy line indicates a break where part of the object is not shown. Confusing the dashed and chain conventions turns a hidden bore into a centre line and vice versa.

technical-reasoning-applied-s02-q04: Third-angle places each view on the side from which it was taken, so the right-hand view sits to the right. First-angle does the opposite, which is why a drawing must always be checked for its projection symbol before any view is interpreted.

technical-reasoning-applied-s02-q05: A flow requirement is only meaningful together with the pressure it is measured at, and at 3 bar the pump falls 2 L/min short. The 45 L/min figure is the distractor doing the work: it is a real number from the same pump, but it is measured at a pressure the specification does not ask about.

technical-reasoning-applied-s03-q01: A humming, warming motor proves the supply and the control circuit

are already doing their job, which rules the fuse and the controller out before you touch them. The evidence points downstream, to a mechanical obstruction or a broken coupling.

technical-reasoning-applied-s03-q02: Testing at the midpoint of a signal or flow path tells you which half the fault is in, and repeating that halves the search each time. Sixteen possible locations become four tests rather than sixteen. Testing the most likely part first is a reasonable habit, but it does not bound the worst case the way halving does.

technical-reasoning-applied-s03-q03: Two observations conflict, and the ram is the more reliable witness: lifting a load is impossible without pressure, so the instrument reporting zero is the thing that must be wrong. Chasing the pump treats the least trustworthy reading as the fact and the demonstrated behaviour as the anomaly.

technical-reasoning-applied-s03-q04: A fault that correlates with running time and temperature points at thermal expansion or thermal drift, because that is the variable actually changing. A software defect is the tempting catch-all, but code does not usually care how long the machine has been warm unless a timer or a sensor threshold is involved.

technical-reasoning-applied-s03-q05: A fault that only appeared under load or when hot has not been proved fixed by a cold no-load run, and the record is what makes the next occurrence diagnosable. Clearing the counter without testing destroys the only evidence that would show the fault recurring.

technical-reasoning-applied-s04-q01: The saving is in scheduling and in the damage avoided, not in the parts themselves. Planned maintenance often replaces components with life left in them. Claiming it eliminates failures overstates it: random and infant-mortality failures are unaffected by a service interval.

technical-reasoning-applied-s04-q02: The bore is larger than the shaft at every measured value, so there is always a gap: 0.04 mm of clearance. A transition fit is the near-miss. That is when the tolerance bands overlap, so the same pair could come out either clearance or interference.

technical-reasoning-applied-s04-q03: Oil thins as it warms, so the grade is chosen to keep a load-carrying film at working temperature. 'Higher is always better' is the intuitive error: too thick and the oil will not reach a tight clearance or a cold bearing, which starves the surface it was meant to protect.

technical-reasoning-applied-s04-q04: Two dissimilar metals plus an electrolyte form a cell, and the less noble metal, the aluminium, is the one that wastes away. Cleanliness does not help, because the driver is the potential difference between the metals rather than dirt; breaking the electrical path between them does.

technical-reasoning-applied-s04-q05: Heat and noise immediately after fitting point at how it was fitted: excessive preload, a bearing driven on through its rolling elements, or misalignment all load the raceways continuously. 'Running-in' is the comfortable answer and the dangerous one, because a bearing left to run hot will fail again quickly.
