

**ATLANTIS NDT**

Liquid Penetrant Testing (PT) Level II

General Examination — Practice Questions

40 multiple-choice questions with an answer key and explanations

Candidate name	
Date	
Time allowed (suggested)	90 minutes
Score	____ / 40

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Before you start

Forty original questions on penetrant principles, penetrant systems and materials, processing technique, process control checks and the interpretation of indications. The set includes worked unit conversions and make-up calculations of the kind a Level II meets in practice.

Choose the single best answer for each question. Work without notes first, then check yourself against the answer key at the back. Under ASNT SNT-TC-1A your employer's written practice sets the passing grade and the number of questions in the real examination.

These are original study questions written by Atlantis NDT. They are not taken from, and do not reproduce, any ASNT or employer examination.

1. A liquid is said to wet a solid surface well when its contact angle with that surface is:

- A. Greater than 90°
- B. Exactly 90°
- C. Small, approaching 0°
- D. Close to 180°

2. For a liquid that wets the surface, capillary rise in a narrow opening is roughly inversely proportional to the width of the opening. If one crack is half as wide as another in the same material, the capillary rise of the same penetrant in the narrower crack is about:

- A. Half as much
- B. The same
- C. Four times as much
- D. Twice as much

3. Penetrant viscosity mainly affects:

- A. How fast the penetrant spreads over the surface and fills openings
- B. Whether the penetrant can enter a crack at all, however long it dwells
- C. The color of the final indication
- D. The UV-A wavelength needed to make the dye fluoresce

4. UV-A lamps used for fluorescent penetrant inspection are designed to emit most strongly at a wavelength of about:

- A. 254 nm
- B. 365 nm
- C. 450 nm
- D. 550 nm

5. In standard penetrant terminology, penetrant dwell time is measured as:

- A. The time from the end of the rinse to the start of developing
- B. Only the time after application is complete and the penetrant has fully drained
- C. The time the developer is left on the part before viewing
- D. All the time the penetrant is in contact with the surface, including application and drain time

6. A part is examined near the bottom of the procedure's permitted temperature range. What is the main effect on the penetrant?

- A. It becomes more viscous, so it enters openings more slowly
- B. Its volatile carrier evaporates faster than at room temperature
- C. A visible dye loses its red color
- D. Its surface tension falls, so it wets the part more readily

7. What is the most likely problem when penetrant is applied to a part whose surface is well above the procedure's maximum temperature?

- A. The penetrant becomes too viscous to enter tight cracks until the part cools
- B. The developer will not adhere to the surface afterward
- C. Capillary action stops working once the surface is warm
- D. Its volatile constituents evaporate and it can dry on the surface

8. A contact thermometer on the part reads 54 °C. The procedure's temperature range is 40-125 °F. Is the part within range?

- A. Yes; 54 °C is about 97 °F
- B. Yes; 54 °C is about 122 °F
- C. No; 54 °C is about 129 °F
- D. No; 54 °C is about 140 °F

9. In the sensitivity classification used in AMS 2644 and ASTM E1417 for Type I (fluorescent) penetrants, which level is the most sensitive?

- A. Level 1/2
- B. Level 1
- C. Level 3
- D. Level 4

10. A shop changes from a Level 2 to a Level 4 fluorescent penetrant for rough as-cast parts and changes nothing else. What is the most likely result?

- A. No change, because sensitivity level only matters on smooth parts
- B. Heavier background fluorescence that can mask or mimic indications
- C. Indications become smaller than the discontinuities causing them
- D. The penetrant can no longer be removed with a water rinse

11. For which job is a water-washable (Method A) penetrant usually the most practical choice?

- A. High volumes of rough-surfaced castings and threaded parts
- B. Very shallow, wide discontinuities on smooth machined parts
- C. A single field weld at a site with no water supply
- D. Parts that must not be exposed to water at any stage

12. A single pipe-support weld on a rack must be examined where no water or electrical power is available. Which system fits best?

- A. Type I, Method D processed in an immersion line
- B. Type I, Method B with a lipophilic emulsifier dip tank
- C. Type II, Method C using aerosol penetrant, remover and nonaqueous developer
- D. Type I, Method A with a portable UV-A lamp and a recirculating-air drying oven

13. Why is a lipophilic emulsifier (Method B) normally applied by immersion or flowing rather than by brushing?

- A. Brushing mixes it unevenly into the penetrant, risking over-removal
- B. Lipophilic emulsifier can be brushed only onto visible penetrants
- C. A brushed coat dries before the emulsification time has started
- D. Immersion is required so the emulsifier reaches the inside of hollow parts

14. In a hydrophilic post-emulsifiable process (Method D), what is the purpose of the water pre-rinse before the remover is applied?

- A. To start the emulsification reaction so the remover can then act more quickly
- B. To wet the part so that the developer will adhere
- C. To cool the part before it enters the remover tank
- D. To wash off most of the surface penetrant before the remover is applied

15. In the developer classification of AMS 2644 and ASTM E1417, a nonaqueous developer intended for Type I (fluorescent) penetrant is designated Form:

- A. a
- B. b
- C. c
- D. d

16. Water-soluble developer (Form b) is generally not used with which penetrant system?

- A. Type I, Method A (water-washable)
- B. Type I, Method B (lipophilic post-emulsifiable)
- C. Type I, Method D (hydrophilic post-emulsifiable)
- D. Type I penetrants of sensitivity Level 3 or 4

17. A solvent remover labeled Class 2 under AMS 2644 and ASTM E1417 is:

- A. Halogenated
- B. Non-halogenated
- C. A water-based hydrophilic remover
- D. A specific-application remover

18. Which sequence is correct for a fluorescent lipophilic post-emulsifiable (Method B) process using dry powder developer?

- A. Clean, penetrant, dwell, water pre-rinse, emulsifier, emulsification time, final rinse, dry, developer
- B. Clean, penetrant, dwell, emulsifier, emulsification time, water rinse, dry, developer
- C. Clean, emulsifier, penetrant, dwell, water rinse, developer, dry
- D. Clean, penetrant, dwell, emulsifier, developer, water rinse, dry

19. In a typical water-washable line using aqueous (water-suspendable) developer, where does the drying step fall in the sequence?

- A. Before the developer, as it does with dry powder developer
- B. After the developer, which is applied to the wet, rinsed part
- C. Nowhere; aqueous developer is viewed while still wet
- D. Only after interpretation, to dry the part before post-cleaning

20. Why do procedures limit the time between removing excess penetrant (and drying) and applying developer?

- A. Penetrant in shallow openings can dry out, so less of it bleeds into the developer
- B. Developer applied late draws penetrant from the surface background instead of the openings
- C. The emulsifier keeps acting on the part until the developer stops it
- D. The UV-A lamp must not be left on for long between parts

21. A drying oven is set much hotter than the procedure allows. What is the main risk to the examination?

- A. Developer builds up too thickly on the part
- B. Background fluorescence increases across the part
- C. The emulsifier carried over on the part becomes more aggressive and over-removes penetrant
- D. Penetrant in discontinuities dries out and fluorescent dye can lose brightness

22. A part that has already been processed and examined must be reprocessed. What must be done first?

- A. Apply a fresh coat of developer over the old coating
- B. Reapply penetrant directly over the old developer
- C. Remove all developer and penetrant, then repeat every step
- D. Re-examine under a brighter UV-A lamp instead of reprocessing

23. A 250 L hydrophilic remover tank is to be made up at 10% concentration by volume. How much remover concentrate is needed?

- A. 2.5 L concentrate and 247.5 L water
- B. 10 L concentrate and 240 L water
- C. 25 L concentrate and 225 L water
- D. 50 L concentrate and 200 L water

24. A part was acid-etched before fluorescent PT but was not properly neutralized and rinsed. What is the most likely effect?

- A. Brighter indications, because the acid has etched the openings wider and deeper
- B. Acid residue in discontinuities can reduce or destroy the dye's fluorescence
- C. No effect, provided the part is completely dry
- D. The developer turns pink wherever acid remains

25. A known-defect panel has a chrome-plated area with crack centers and a separate grit-blasted area (as on the PSM-5 type). What is the grit-blasted area used to judge?

- A. Fine-crack detection sensitivity
- B. UV-A intensity at the panel surface
- C. Removal (washability) and background
- D. Developer coating thickness

26. Why is the dry powder developer in a fluorescent line periodically examined under UV-A?

- A. To confirm the powder fluoresces brightly enough to give a uniform viewing background
- B. To estimate its particle size from the glow
- C. To check the UV-A lamp's output against the powder
- D. To find fluorescent penetrant contamination that could cause false indications

27. The concentration of a water-soluble or water-suspendable developer bath is commonly checked with:

- A. A refractometer
- B. A hydrometer
- C. A UV-A radiometer
- D. A settling tube

28. A white-light meter at the examination surface reads 1,300 lx. Approximately what is this in foot-candles? (1 fc = 10.76 lx)

- A. About 13 fc
- B. About 121 fc
- C. About 140 fc
- D. About 1,300 fc

29. A UV-A radiometer reads 1,200 $\mu\text{W}/\text{cm}^2$. Expressed in W/m^2 , this is:

- A. 0.12 W/m^2
- B. 1.2 W/m^2
- C. 120 W/m^2
- D. 12 W/m^2

30. Grinding cracks on a hardened steel surface typically appear in PT as:

- A. A single straight line running exactly along the grinding marks
- B. Isolated round spots spread evenly over the ground area
- C. A crazed network, or fine lines across the grinding direction
- D. A broad, diffuse stain over the whole ground area

31. A star-shaped indication at the end of a weld bead most likely shows:

- A. A crater crack
- B. Lack of sidewall fusion
- C. Undercut
- D. A slag inclusion

32. On a casting, a smooth-edged linear indication where two streams of molten metal met without fully fusing is most likely:

- A. A hot tear
- B. A cold shut
- C. Gas porosity
- D. A forging lap

33. When examining an in-service part for fatigue cracks, where should the examination be concentrated?

- A. At stress raisers such as fillet radii, hole edges and thread roots
- B. On flat, lightly loaded areas away from any change in section
- C. Only on areas where the paint has been left intact
- D. Only on the thickest sections of the part

34. Fine, highly branched cracks are found on an austenitic stainless steel pipe near a weld in a chloride-bearing environment. The most likely mechanism is:

- A. Mechanical fatigue
- B. Lamination
- C. Chloride stress corrosion cracking
- D. Lack of fusion

35. PT on the flame-cut edge of a thick plate shows a linear indication running parallel to the plate faces near mid-thickness. This is most likely:

- A. A lamination
- B. A crater crack
- C. A cold shut
- D. A grinding crack

36. During fluorescent inspection a bright line is traced to a lint fiber that picked up penetrant from the inspector's glove. How is the indication best classified?

- A. False; it does not come from an opening in the part
- B. Relevant, because it is linear and clearly visible
- C. Nonrelevant, caused by the part's design or geometry
- D. Rejectable, because it is a linear indication

37. Which statement correctly separates interpretation from evaluation?

- A. They are the same step described with different words
- B. Evaluation decides whether an indication is relevant; interpretation then applies the acceptance criteria
- C. Interpretation is reserved for Level III personnel; evaluation may be done by Level I
- D. Interpretation decides whether it is relevant; evaluation judges it against acceptance criteria

38. What can a PT indication reliably tell you about the depth of a discontinuity?

- A. Its exact depth, calculated from the width of the indication
- B. Its depth, judged from how many minutes the indication takes to appear
- C. Nothing exact; bleed-out only hints at the volume of trapped penetrant
- D. Its depth, provided a fluorescent penetrant of Level 3 or higher is used

39. After a solvent-removable visible-dye examination, the whole developed area shows a uniform pink haze. The most likely cause is:

- A. Over-removal of the excess penetrant
- B. Inadequate removal of the excess surface penetrant
- C. A developer coat that was too thin
- D. A penetrant dwell time that was too short

40. On a weld known to contain a crack, a visible-dye examination shows only a faint, light pink line. Which processing error is most likely?

- A. Excess penetrant was left on the surface
- B. The penetrant was brushed on instead of sprayed, as the procedure allows
- C. Excessive cleaning during removal took penetrant out of the crack
- D. The dwell time was much longer than the minimum

Answer key and explanations

1. C	2. D	3. A	4. B	5. D	6. A	7. D	8. C	9. D	10. B
11. A	12. C	13. A	14. D	15. D	16. A	17. B	18. B	19. B	20. A
21. D	22. C	23. C	24. B	25. C	26. D	27. B	28. B	29. D	30. C
31. A	32. B	33. A	34. C	35. A	36. A	37. D	38. C	39. B	40. C

1. C — The smaller the contact angle, the further the liquid spreads over the surface and the stronger its capillary pull into a narrow opening. A liquid with a contact angle above 90° is pushed out of a narrow opening rather than drawn into it. [General PT principle (wetting and capillarity)]
2. D — Capillary rise $h \approx 2\gamma\cos\theta / (\rho \cdot g \cdot w)$ scales with $1/w$ for the same liquid and surface, so $h_2 = h_1 \times (w_1 / w_2) = h_1 \times 2$. A narrower opening still holds less penetrant in total, so tight cracks need adequate dwell and a sensitive enough system to show. [General PT principle (capillary rise)]
3. A — Viscosity governs the rate of flow, so a thicker penetrant needs longer to cover the surface and fill openings. Whether it can enter at all depends mainly on wetting (surface tension and contact angle), not on viscosity. [General PT principle]
4. B — Inspection lamps peak near 365 nm in the UV-A band, which excites the dye to emit visible yellow-green light. 254 nm is short-wave UV-C, which is hazardous and not used, and 450–550 nm is already visible light. [ASTM E1417; ASTM E3022]
5. D — Dwell time runs from first contact until removal begins, and it includes the time taken to apply the penetrant and the drain time. The time the developer is left on is the development time, a separate step with its own limits. [ASTM E1316 (terminology); ASTM E165]
6. A — Cold penetrant is thicker and flows more slowly, which is why some codes lengthen minimum dwell times at the low end of the range. Below the qualified range the procedure has to be qualified for that temperature rather than simply given a longer dwell. [General PT principle]
7. D — Heat drives off the volatile part of the penetrant, so it thickens or dries before it can enter and later bleed out, and some fluorescent dyes lose brightness when overheated. High-temperature work needs materials and a procedure qualified for that temperature. [General PT principle]
8. C — $^{\circ}\text{F} = ^{\circ}\text{C} \times 1.8 + 32 = 54 \times 1.8 + 32 = 97.2 + 32 = 129.2 ^{\circ}\text{F}$, which is above 125 °F (52 °C). Let the part cool into range, or use a procedure qualified for the higher temperature; 97 °F is the error of forgetting to add 32. [Unit conversion; general PT practice]
9. D — Type I sensitivity runs from Level 1/2 (ultra-low) through Levels 1, 2 and 3 to Level 4 (ultra-high). Higher levels reveal finer discontinuities but are also harder to remove from rough surfaces. [AMS 2644; ASTM E1417]
10. B — A more sensitive penetrant is also held more strongly by surface roughness, so rough parts show more background. The sensitivity level is chosen to suit both the smallest discontinuity of interest and the surface condition. [General PT principle; ASTM E1417]
11. A — Method A rinses easily and quickly off rough and complex surfaces, which suits production lines. The trade-off is that the rinse can also remove penetrant from shallow, wide openings, and it needs water, so it does not suit isolated field work. [ASTM E165; general PT practice]
12. C — A visible solvent-removable kit is portable and needs only the aerosols, lint-free cloths and adequate white light, which is why it dominates field work. The other systems need rinse water, tanks, UV-A lighting or an oven. [ASTM E165; general PT practice]
13. A — Lipophilic emulsifier acts by diffusing into the oily penetrant layer over a controlled time. Brushing adds mechanical mixing that speeds the action unevenly and risks over-removal, whereas

immersion or flow-on followed by a timed drain keeps it controlled. [ASTM E1417; ASTM E165]

14. D — The pre-rinse removes the bulk of the oily surface penetrant before the remover is used. That limits penetrant build-up in the remover bath and leaves the remover only a thin film to act on, which makes the removal step easier to control. [ASTM E1417; ASTM E165]

15. D — Form a is dry powder, Form b water-soluble, Form c water-suspendable and Form d nonaqueous for Type I. Form e is nonaqueous for Type II, and Form f covers specific applications. [AMS 2644; ASTM E1417]

16. A — A water-washable penetrant already contains its emulsifier, so a water-based developer solution can dissolve it and wash it out of shallow discontinuities. Water-soluble developer is also normally excluded for Type II (visible) penetrants because it does not form the white contrasting coat they need; check the exclusions in the specification your procedure follows. [ASTM E165; ASTM E1417; general PT practice]

17. B — Class 1 removers are halogenated, Class 2 non-halogenated and Class 3 specific-application. Non-halogenated removers are usually chosen where halogen residues are a concern, such as on austenitic stainless steel and titanium, though certified contaminant limits still apply where a code requires them. [AMS 2644; ASTM E1417]

18. B — Lipophilic emulsifier goes straight onto the penetrant-coated surface with no pre-rinse, acts for a controlled time and is then rinsed off with water. Dry powder developer is applied to a dry part, so drying comes before developing. A water rinse before the remover belongs to Method D. [ASTM E1417; ASTM E165]

19. B — In a typical line aqueous developer is applied to the wet part straight after rinsing, and drying then forms the developer coating. Dry powder and nonaqueous developers, by contrast, go onto a part that has already been dried. [ASTM E1417; ASTM E165]

20. A — Developer works on penetrant that is still liquid in the opening. A long delay, especially on a warm part, lets it thicken or evaporate and weakens or loses indications from fine discontinuities. [General PT principle; ASME BPVC Section V, Article 6]

21. D — Overdrying bakes the penetrant in the opening so it no longer bleeds out well, and heat can degrade fluorescent dyes. Procedures cap oven and part temperatures, and parts should leave the oven as soon as they are dry. [ASTM E1417; general PT principle]

22. C — Old developer blocks openings, and old penetrant residue changes how new penetrant enters and bleeds out. The part is cleaned completely and taken through every step again; repeated reprocessing can still weaken indications, so it is kept to a minimum. [ASTM E1417; general PT practice]

23. C — Concentrate = $0.10 \times 250 \text{ L} = 25 \text{ L}$, leaving $250 - 25 = 225 \text{ L}$ of water. The concentration used must be within the manufacturer's and procedure's limits and is then verified, typically with a refractometer. [Calculation; ASTM E1417]

24. B — Acids and chromates left in openings attack fluorescent dyes and reduce their brightness, so a real crack may give a faint indication or none. Etching must be followed by neutralizing, rinsing and drying. [ASTM E1417; ASTM E165]

25. C — The crack centers show whether the system still detects fine cracks, while the grit-blasted area shows how easily surface penetrant comes off and how much background remains. Both are compared with a record made when the materials were known to be good. [ASTM E1417; general PT practice]

26. D — Dry developer picks up penetrant from processed parts, and fluorescent specks in the powder can be transferred to a part and look like indications. Clean developer should show no significant fluorescence. [ASTM E1417]

27. B — Aqueous developer concentration is checked by specific gravity with a hydrometer against the manufacturer's values. A refractometer is used for hydrophilic remover concentration, and a settling tube belongs to wet magnetic particle testing. [ASTM E1417]
28. B — $fc = lx \div 10.76 = 1,300 \div 10.76 \approx 121$ fc. That exceeds a 100 fc (1,076 lx) minimum such as the one in ASME Section V Article 6. [Unit conversion; ASME BPVC Section V, Article 6 (2023)]
29. D — $1 \mu\text{W}/\text{cm}^2 = 10^{-6} \text{ W} \div 10^{-4} \text{ m}^2 = 0.01 \text{ W}/\text{m}^2$, so $1,200 \times 0.01 = 12 \text{ W}/\text{m}^2$. ASME Section V Article 6 states its UV-A minimum as $1,000 \mu\text{W}/\text{cm}^2$ and ISO 3059 states $10 \text{ W}/\text{m}^2$, which is the same value. [Unit conversion; ASME BPVC Section V, Article 6 (2023); ISO 3059]
30. C — Local overheating during grinding sets up thermal stresses that crack the surface in a crazed network or in fine lines across the grinding direction. Lines that follow the grinding marks exactly are more often surface texture and need confirming. [General PT interpretation]
31. A — Crater cracks form as the weld pool at the end of a pass solidifies and shrinks, often in a star or radiating pattern. Lack of fusion and slag are usually below the surface, and undercut is an open groove at the toe that is normally measured during visual examination. [General PT interpretation (weld discontinuities)]
32. B — A cold shut forms where streams of metal that have cooled too far meet but do not fuse, leaving a smooth, often curved line. Hot tears are ragged and usually sit at changes in section, porosity gives rounded indications, and laps occur in wrought products. [General PT interpretation (casting discontinuities)]
33. A — Fatigue cracks start where cyclic stress is highest, at geometric stress raisers and surface damage. Knowing how the part is loaded and where cracks are likely to start is part of a Level II's interpretation. [General PT interpretation (service discontinuities)]
34. C — Chloride stress corrosion cracking of austenitic stainless steel typically gives fine, branched cracks, often where residual stress is high, such as weld heat-affected zones. Fatigue cracks are usually single and unbranched. [General PT interpretation (service discontinuities)]
35. A — Laminations lie parallel to the plate surface, so PT can show them only where they break out on edges and cut faces. On the plate faces themselves they are not visible to PT. [General PT interpretation (product-form discontinuities)]
36. A — A false indication is produced by something other than a discontinuity, here penetrant carried on a fiber, so the fiber is removed and the area re-examined to confirm nothing lies beneath it. Bleed-out from a press fit or keyway is a different case: penetrant from a real opening that is part of the design. ASTM E1316 counts false indications among nonrelevant ones, and either kind must be confirmed before it is set aside. [ASTM E1316 (terminology); general PT interpretation]
37. D — In ASTM E1316 terms, interpretation determines whether an indication is relevant, nonrelevant or false, and evaluation then determines whether a relevant indication is cause to accept or reject the part. A Level II is normally qualified to do both. [ASTM E1316 (terminology); ASNT SNT-TC-1A]
38. C — The volume of penetrant in an opening affects how fast and how much it bleeds out, so a large, quick indication hints at a larger discontinuity. PT cannot measure depth; progressive grinding with re-examination, or a method such as UT, is needed. [General PT interpretation]
39. B — Surface penetrant left behind after removal stains the developer everywhere, giving a background that can hide real indications. The area is cleaned and re-examined with better removal technique. [General PT practice; ASME BPVC Section V, Article 6]
40. C — Over-removal, for example using too much solvent, draws penetrant out of the discontinuity so less is left to stain the developer. ASME Section V Article 6 notes that light pink indications may

indicate excessive cleaning. [ASME BPVC Section V, Article 6 (2023); general PT practice]

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