Methodology for setting up questions for examination (AME)
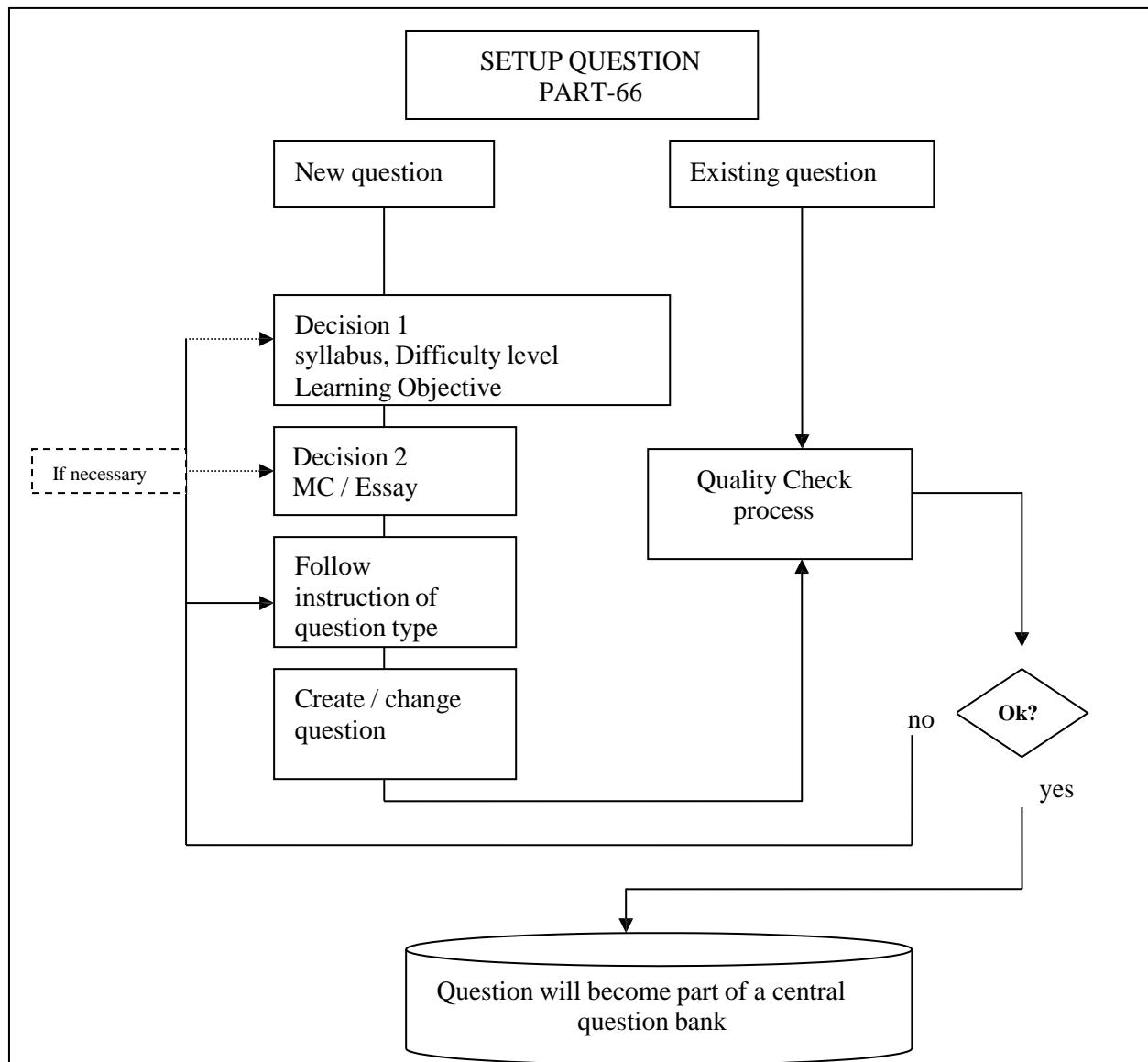
Content

1 Requirements

1.1. Principal requirements

(a) Questions must be written in Aviation language.

(b) Questions that require specialised knowledge of specific aircraft types should not be asked in a basic licence examination.

(c) Multiple-choice question must have three alternative answers of which only one must be the correct answer and the candidate must be allowed a time per module which is based upon a nominal average of 75 seconds per question.

(d) The primary purpose of essay questions is to determine that the candidate can express themselves in a clear and concise manner and can prepare a concise technical report for the maintenance record, which is why only a few essay questions are required. The candidate must be allowed a time per essay question of 20 minutes.

(e) The examination should measure clearly formulated goals. Therefore the field and depth of knowledge to be measured by each question must be fully identified.

(f) For pass mark purposes, the essay questions should be considered as separate from the multiple-choice questions.

(g) For a better descriptiveness and in order to remain close to reality, the use of diagrams is particularly suitable. The use of diagrams in questions must follow to the rules of the appendix "Using Diagrams".

(h) Calculators are not allowed during examination. Therefore all calculations should be feasible without a calculator. Where a question involves calculations not feasible without a calculator, such as $\sqrt{10}$, then the question should specify the approximate value of $\sqrt{10}$.

(i) The use of abbreviations, and acronyms should generally be avoided.

However where needed, only internationally recognised abbreviations, acronyms should be used. In case of doubt use the full form, e.g. angle of attack = 12 degrees instead of a= 12°. This means, for example, that only abbreviations commonly employed in the specialist field are used, without an additional spelled-out explanation in brackets.

(j) The use of units must follow the international rules and style conventions.

(k) Questions must be referred to the syllabus, the category and the learning objectives.

(l) The layout of question should be homogenous. Only one font may be used for the question and the answer text. For the better optical distinction the additional elements like statements, situations or scenarios should be distinguished homogeneously by using different colours. The direct question text should be of course identifiable. It should be separated from opening text by an empty line, always begin at a new line and positioned at the end of the question text.

1.2. Quality Circle Setup and Review Questions

The picture below shows the general workflow which should be followed when setting up new questions or reviewing existing questions. The use of the diagram shall also support the aim to get a common quality level of questions.

SETUP QUESTION
PART-66

New question

Existing question

Decision 1
syllabus, Difficulty level
Learning Objective

Decision 2
MC / Essay

If necessary

Follow
instruction of
question type

Create / change
question

Quality Check
process

Ok?

no

yes

Question will become part of a central
question bank

1.3.   Ongoing Quality Circle

Before a question appears in an examination it should be checked by one or more Module Experts and by students in the advanced stage. Their judgment guarantees the clear understanding of the meaning of a question and its reply.

The figure below shows the standard quality process.

Workflow

1. Author(s) write questions
2. Experts review Questions
3. Experts decide and release the question when it is ok
4. Question appears in exam
5. Feed back:
    5.1 If the question is ok-------------Question stays in the bank
    5.2 If the question is not ok---------Go to 1 and 2

Process
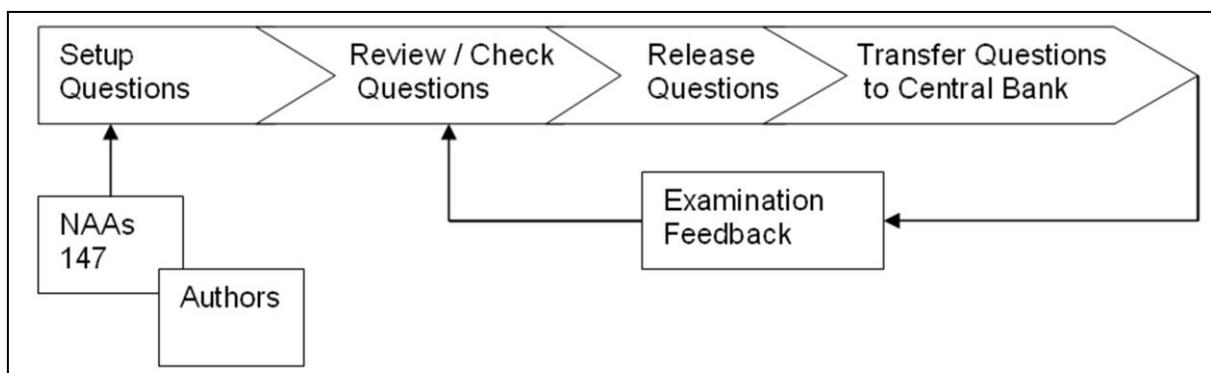
1.4. Question Review Checklist

The main purpose of the question review checklist is to help evaluating existing question against the basic requirements described in this methodology.
Hereafter an example for Part 66 requirements:

CAAB	Part-66	Question Review Checklist		
Name		Module	Date	

Question Number	Relevance to Part-66 Syllabus						Remark	Proposal	Validation
	Conformaty with Part-66 Level and Category								
	Content check and justification of false answers								
	Conformity with Part-66 formal question standard								
	Conformity with Part-66 wording question standard								
	Simplicity and correctness of the English language								
	1	2	3	4	5	6			
1	☐	☐	☐	☐	☐	☐			☐
2	☐	☐	☐	☐	☐	☐			☐
3	☐	☐	☐	☐	☐	☐			☐
4	☐	☐	☐	☐	☐	☐			☐
5	☐	☐	☐	☐	☐	☐			☐
6	☐	☐	☐	☐	☐	☐			☐
7	☐	☐	☐	☐	☐	☐			☐
8	☐	☐	☐	☐	☐	☐			☐
9	☐	☐	☐	☐	☐	☐			☐
10	☐	☐	☐	☐	☐	☐			☐
11	☐	☐	☐	☐	☐	☐			☐
12	☐	☐	☐	☐	☐	☐			☐
13	☐	☐	☐	☐	☐	☐			☐
14	☐	☐	☐	☐	☐	☐			☐
15	☐	☐	☐	☐	☐	☐			☐
16	☐	☐	☐	☐	☐	☐			☐
17	☐	☐	☐	☐	☐	☐			☐
18	☐	☐	☐	☐	☐	☐			☐
19	☐	☐	☐	☐	☐	☐			☐
20	☐	☐	☐	☐	☐	☐			☐
21	☐	☐	☐	☐	☐	☐			☐
22	☐	☐	☐	☐	☐	☐			☐
23	☐	☐	☐	☐	☐	☐			☐
24	☐	☐	☐	☐	☐	☐			☐
25	☐	☐	☐	☐	☐	☐			☐

2   Setup Multiple-choice Questions

2.1.   Preface

Multiple-choice questions are not a panacea. They have advantages and limitations just as any other type of question. Authors of questions need to be aware of these characteristics in order to use multiple-choice questions effectively.

Multiple-choice questions are appropriate for use in each syllabus, and can be used to measure a great variety of educational objectives. They are adaptable to the learning objectives, from simple recall of knowledge to more complex levels, such as the applicants' ability to:

- analyze phenomena,
- apply principles to new situations,
- comprehend concepts and principles,
- discriminate between fact and opinion,
- interpret cause-and-effect relationships,
- interpret charts and graphs,
- judge the relevance of information,
- make inferences from given data,
- solve problems.

The difficulty level of multiple-choice questions can be ensured by rephrasing the answers and/or changing the order of the alternatives.

2.1.1.   Validity

In general, it takes much longer to respond to an essay test question than it does to respond to a multiple-choice question, since the composing and recording of an essay answer is such a slow process. A candidate is therefore able to answer many multiple-choice questions in the time it would take to answer a single essay question. This feature enables to test a broader sample of the syllabus in a given amount of testing time. Consequently, the test is likely to be more representative of the candidates overall achievement.

Ultimately, the validity (and reliability) of the examination depends on the quality of the individual questions. Questions are most likely to be suitable for use in an examination when they fulfill the criteria below. The following principles should be observed when developing multiple-choice questions.

A question will contribute to the validity of the examination, if following conditions are considered:

(a) The chosen subject matter of the questions is relevant to the practical work.
    Splitting hairs should be avoided, as should be trivialities.

(b) The level is correct.

    An examination which is primarily intended to test the understanding and application competence of knowledge should not consist of questions that merely require the availability of memorised individual facts.

(c) It focuses on a clearly defined content or problem and is a self-contained entity.

(d) There is clearly one true solution.

    Content on which there are controversial scholarly opinions are unsuitable for the multiple-choice method, unless a specific scholarly opinion is expressly asked for.

2.1.2.   Efficiency

Multiple-choice questions are amenable to rapid scoring, which is often done by using a master-solution template for paper & pencil (written) examinations. This expedites the notification of test results to the candidates.

2.1.3. Difficulty of Construction

Good multiple-choice questions are generally more difficult and time-consuming to write than other types of questions. Coming up with plausible alternative answers require a certain amount of skill. This skill, however, may be increased through study, practice, and experience.

2.2.   Writing Multiple-choice Questions

These instructions describe the methodology to be followed when writing multiple- choice questions. Behind a description of general rules, correct phrasing and avoidance of unintended cues, the instructions are illustrated as far as possible with question examples. Whenever necessary an example will illustrate the use of the relevant rule, by comparison of a poor solution with a better solution.

Please do not use any of the example questions for a real examination. The used examples in this guidance manual are only designed to show the principles of the relevant rule.

It needs to be emphasised here that the present instructions neither replace experience nor do they save the time commitment required to produce good multiple-choice elements.

New authors are recommended to learn writing and revising multiple-choice elements at a workshop lasting at least one day (see also 5.2). Ideally, authors should furthermore be regularly kept up to date about the results of their reviewed questions so that they are able to learn from their mistakes. Producing questions takes time: even practised authors take at least one hour to produce a multiple-choice question (see also 5.)

2.2.1. Anatomy of a Multiple-choice Questions

A multiple-choice question consists of two basic parts:
- The question text, which can be just a question or a problem (situation/scenario). The problem may be in the form of either a direct question or an incomplete statement.
- The list of answers. It has one true answer and two incorrect answers.

Multiple-choice Question

The valve which allows oil to either flow through or by-pass a serviceable engine oil cooler is:	⟵ **Question Text**
False ⟶ *a. pressure activated*	
False ⟶ *b. manually activated*	⟵ **Answers**
True ⟶ **c. temperature activated*	
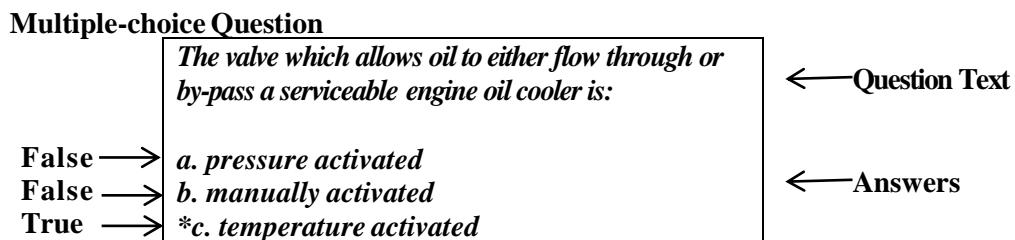
2.2.2. Multiple-choice question types

Multiple-choice "1 from 3" can be raised as
- Positive single choice out of three answers to choose from
- Negative single choice out of three answers to choose from

Often the positive form of multiple-choice questions is as well suited as the negatively phrased type, with regard to validity as well as reliability.

2.2.3. Principals of writing Multiple-choice Questions

When devising multiple-choice elements as a part of a multiple-choice question the questions thus produced should, as a rule, test more than mere factual knowledge and be largely free from formal errors. They should be good enough to ensure the validity and reliability of an examination.

If multiple-choice questions are to test more than factual knowledge, complex problems need to be presented which contain several pieces of information that need to be interpreted and integrated. Good questions therefore frequently require an elaborate core.

The following principals should be observed when developing multiple-choice questions:

2.2.3.1. Specifications to write Multiple-choice Question Text

(a) In multiple-choice questions, answers will often have to be weighed. In almost all cases, this is only possible if they are short and clear.

The question formulation (statement, situation, scenario) may be long, but the answers should be short!
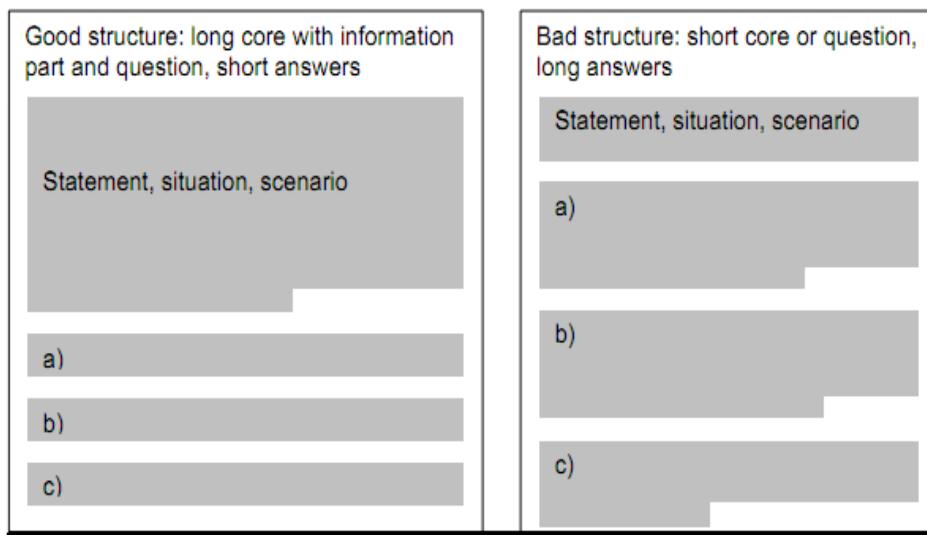
(b) Questions and answers should be formulated as simply as possible: the examination is not a test of language. Complex sentences, unusual grammar and double negatives should be avoided. Questions should not deliberately be made complicated or intentionally designed as trick questions.

When phrasing questions you should ensure that the question text

- contains all the information required for the answer so that no additional information needs to be given in the answer,
- does not, as a rule, contain superfluous information:

  The exception is a question intended to test the ability to filter out relevant information. But otherwise precious time would be wasted by including unnecessary text,

- should always be phrased positively:

  Negative questions are not desirable from a validity point of view. A negative phrasing of the question text will invariably result in confusing double negatives.

(c) The difficulty of a question should be determined by the complexity of the underlying problem, the level (understanding, problem solving), and the subtlety of the required differentiation (proximity of the possible answers to each other). It is unfair and certainly contrary to the intention of the test to use formal tricks in order to make a simple question more difficult.

What does the subject matter of the question aim at?

The syllabi specify the topics on which questions must be written. Questions should always refer to a narrow aspect, i.e. at the lowest level. This avoids questions that are too abstract.

If the following question is asked on a Part 66 Module 1 subject:

 "Which of the following statements about percentage calculation applies?"

The subject is certainly too broad and too heterogeneous for a multiple-choice question.
Relevant questions within a topic are derived mainly from the detailed aspects

- a maintenance technician is most frequently faced with,
- where errors may have grave consequences,
- where erroneous views are widespread.

To check the relevance of the intended topic one may ask the question:

"How important is it that the candidate is able to solve this problem independently or answer the resulting question correctly?"

Starting from your own experience or from a specific non-binding request from a non-specialist can produce extremely application-based and relevant questions.

However, care should be taken not to pick "interesting" special cases.

It is important to use textbooks to verify and document the factual accuracy of a question and the true answer(s). Textbooks may also be helpful for finding good false answers. However, their usefulness as a source of inspiration for questions is limited. Although, whenever the intention is to test theoretical knowledge in the narrower sense (basic knowledge), textbooks do have a place in assisting to phrase or copy questions to test learning objectives. However, this procedure often produces purely academic questions, the suitability of which for testing competence is doubtful.

Check the relevance of the intended topics to the application by asking the question:
"Will an applicant be faced with this problem/question in practice?"

Question texts can consist of a single question:

> ***Which of the following item influences the operation of an automatic fuel control unit on a turbojet engine?***

Or a statement:

> ***The active clearance control (ACC) portion of an EEC system increases turbine engine efficiency by:***

Although it is possible to test relevant knowledge using such texts, they merely test factual knowledge as a rule.

But multiple-choice questions can be and should be also used to test the ability to interpret and to integrate information, and to apply theoretical knowledge to a specific problem.

For this, the question texts should present information about a problem. This, for example, could be a technical case study (fault, repair measures to be taken, etc).

The concrete short question follows separately:

> ***You find that there is exterior damage to a light-alloy propeller blade. The damage consists of slight indentations and notches caused by stones.***
>
> ***What is the correct assessment?***

The information section can contain illustrations, e.g. photographs, graphics, or checklists etc.

2.2.3.2. Specifications to write Multiple-choice Answer Text

Badly chosen and/or phrased answers in a relevant problem situation frequently result in entirely unsuitable questions. To contribute to the validity and reliability of a test, finding the right answer should only depend on whether the knowledge to be tested is available, if possible. To achieve this, the possible answers need to meet a series of content, formal and linguistic criteria.

(a) A question should comprise one complete positive answer.

(b) The correct answer should be absolutely correct and complete or, without doubt, the most preferable. Responses that are so essentially similar that the choice is a matter of opinion rather than a matter of fact should be avoided. The main interest in multiple-choice questions is that

they can be quickly performed: this is not achieved if doubt exists about the correct answer. The right answer should definitely be the only correct one.

(c) Each possible answer should be short and only contain one statement.

(d) All possible answers should fall into the same category, i.e. they should be homogenous in content (e.g. all measurement units, all diagnoses, all causes, all steps/measures, etc.).

(e) There should be good reasons for any false answer. For example, these may be frequent erroneous opinions, wrong concepts, outdated views, etc. There should at least be a clearly understandable relationship with the question subject matter. A justification for each false answer should be written.

(f) Even bad candidates will be able to immediately exclude such implausible, trivial or totally nonsensical false answers. This increases the chance to guess the right answer. It makes no sense at all to provide an absurdity as a false answer.

(g) Overlapping answers should only be used if the underlying problem requires it.They should not be used to intentionally make a question more difficult.

(h) Phrases such as "All the above" or answers such as "Both B as well as C are right" should not be used. If this is the intended right answer, then more than one right answer exists and a matching question should be taken in mind.

(i) The false alternatives should seem equally plausible to anyone ignorant of the subject. All of the alternatives should be clearly related to the question and of similar vocabulary, grammatical construction and length. In numerical questions, the incorrect answers should correspond to procedural errors such as corrections applied in the wrong sense or incorrect unit conversions: they should not be mere random numbers.

False answers do not need to differentiate themselves from the right answer in an obvious way. It is possible to ask candidates to weigh up various different shades of grey.

(j) The answers should be randomised in an individual examination.

2.2.3.3. Formal aspects

Formal criteria are mainly about avoiding any unintended hints at the solution, the "cues". Cues enable MC experienced candidates to identify the correct answer even without any specialist knowledge, or to eliminate incorrect answers thus improving their chance of guessing the correct one. The second objective is to minimize the influence of particular answering trends by candidates. The following examples will illustrate the most important and most frequent cues by these nonsense questions.

Therefore, do not attempt to answer the following questions with regard to the content:

(a) False answers should be almost of the same length and have the same level of differentiation as the correct answer.

Example of an *incorrect* phrasing

> **How often can a locknut with fibre ring be used?**
> **a. twice**
> **b. always once only**
> **c. three times**

Authors are obviously focused on the correct answer and they try to phrase this as precisely as possible. Little attention is paid to the false answer, which is perceived as a mere "background noise". Candidates who are experienced in tests would have a good chance of success by selecting answer "*b.*". It is not always possible to produce answers that are of equivalent length and complexity. However, authors should ensure that the correct answer does not stand out.

(b) All answers should fit the question text grammatically.

Example of an *incorrect* phrasing
> ***The information is part of an a. Annex***
> ***b. Book***
> ***c. Picture***

For reasons of grammar (<u>an</u> Annex, a Book, a Picture, a Video), only (a.) can be the correct answer. It probably happens rarely that two answers can be eliminated, but it will frequently happen that some will not be considered. To check, authors should read each answer together with the question when checking consistency.

(c) Avoid verbal associations between question text and correct answer.

Example of an *incorrect* phrasing
> ***The characteristic of a T-tail unit is…***
> ***a. Rudder and elevator form a U***
> ***b. Rudder and elevator form a T***
> ***c. Rudder and elevator form a V***

the letter T appears in both (question text and answer B), it will increase the likelihood of it being the correct answer. The guessing can be avoided by re-phrasing it or by adding an illustration:

Example of a *better* presentation of the question

> ***The tail unit of the shown aircraft is ...***
>
> ***a. a cross tail unit***
> ***b. a T-tail unit***
> ***c. a V tail unit***

(d) Hidden clues to the right answer should be avoided.

Example of an *incorrect* phrasing

> ***A connection screw can be installed in two different positions. Which location is correct from safety point of view?***
> ***a. The nut must be installed at the bottom, because the bolt will not fall out even when the nut is lost.***
> ***b. The nut must be installed at the top, because it is easier to tighten it.***
> ***c. The nut can be installed as desired, depending on the working position.***
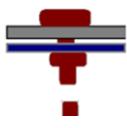
Answer 'a.' will be identified as right even without specialist knowledge since it comes complete with a safety reason.

(e) Absolute terms such as "never", "always" should not be used in order to make statements clearly <u>false</u>. Such absolutes often enable false answers to be identified intuitively. The desired statement is usually clear even without the addition of absolutes.

Example of an *incorrect* phrasing

> ***a. The nut must be installed at the bottom.***
> ***b. The nut must always be installed at the top.***
> ***c. The nut may be installed as desired.***

2.2.3.4. Measuring Higher-Level Objectives with Multiple-choice Questions

Multiple-choice questions are frequently used to measure lower-level objectives, such as those based on knowledge of terms, facts, methods, and principles like knowledge level 1. The real value of multiple-choice questions, however, is their applicability in measuring higher-level objectives, such as those based in comprehension, application, and analysis like knowledge level 2 and 3 of Part-66.

(a) Comprehension

Objective: Identifies the effect of changing a parameter (rule using).

A pendulum consists of a sphere hanging from a string. What will happen to the period of the pendulum if the mass of the sphere is doubled? (Assume that the effects of air friction and the mass of the string are negligible, and that the sphere traces an arc of 20° in a plane as it swings.)

>   *a. It will increase.*
>   *b. It will decrease to half of it.*
>   **c. It will remain unchanged.*

(b) Application

Objective: Identifies the correct application of principle (problem solving).
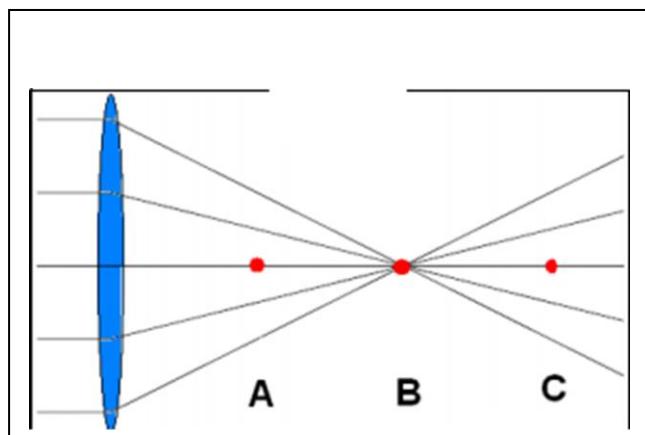
In the diagram above, parallel light rays pass through a convex lens and converge to a focus. They can be made parallel again by placing a:

>   *a. Concave lens at point B.*
>   *b. Concave lens at point C.*
>   **c. Second convex lens at point C*

(c) Analysis

Objective: Analyzes manual text and identifies patterns and relationships.

>   *[The manual text is included here.]*

The chief purpose of statement XY is to:

>   *a. show relation between part 7 and instruction XY*
>   ** b. show relation between part 9 and instruction XY*
>   *c. show relation between part 10 and instruction XY*

2.2.4. Examples

2.2.4.1. Example 1: Positive single choice from three answers to choose from

Definition**:**

Three possible answers or additions to a question or incomplete statement, from which the only right answer should be selected.

Question:

> *In an aircraft with an empty weight of 2100 lbs and an empty weight CG position of +32.5 inches the following changes were made:*
>
> *a. Two 18 lbs passenger seats at station +73 were removed.*
> *b. A modification to the structure was performed at station +77 which increases the weight by 17 lbs.*
> *c. A seat including safety belt weighing a total of 25 lbs were installed at station +74.5.*
> *d. An additional NAV device weighing 35 lbs was installed at station +95.*

...and the appropriate question in the form of a question,

> *What is the new empty weight CG?*

... or an alternative statement.

> *The new empty weight CG is:*

There is only one right answer amongst the three answers to choose from. The other three serve as false answers.

> *a. 30.01*
> *b. 33.68*
> *c. 34.65*

2.2.4.2. Example 2: Negative single choice from three answers to choose from

Definition:

A question or incomplete statement is followed by three answers or additions from which to choose the exception or the least applicable. The negation should be either bolded or underlined.

This question type can be used in those rare cases where knowledge of an important exception is essential. What is actually being tested is the knowledge of the three positive answers. The "right" answer is merely a by-product of the solutions.

However, you should always ask yourself whether a positively formulated question, e.g. knowledge of key (facts/important regulations, right results, most likely consequences) might not be more relevant and more in line with actual use.

Question:
In an aircraft with an empty weight of 2100 lbs and an empty weight CG position of +32.5 inches the following changes were made:

1. Two 18 lbs passenger seats at station +73 were removed.
2. A modification to the structure was performed at station +77 which increases the weight by 17 lbs.
3. A seat including safety belt weighing a total of 25 lbs were installed at station +74.5.
4. A NAV device weighing 35 lbs was repaired at station +95.

...and the appropriate question in the form of a question or a statement,

> *Which item is NOT relevant?*

… or alternative
> *NOT relevant is:*

There is only one true answer amongst the three answers to choose from. The other three serve as false answers.
> *a. 1*
> *b. 2*
> *c. 4*

*Which of the following is **NOT** a good argument in a conflict situation about the correct repair ?*

> **a. "I am the chief, follow my instructions!"*
> *b. "Follow the instructions of the textbook!"*
> *c. "Ask a colleague to get more information!"*

For most educational objectives, candidates achievement is more effectively measured by having him or her identify a correct answer rather than an incorrect answer. Just because the candidate knows an incorrect answer does not necessarily imply that he or she knows the correct answer. For this reason, questions of the negative variety are not recommended for general use. Occasionally, negative questions are appropriate for objectives dealing with safety issues, where knowing what not to do is important. In these situations, negative questions should be carefully worded to avoid confusing the candidate. The negative word should be placed in the question text, not in the alternatives. In addition, each of the alternatives should be phrased positively to avoid forming a confusing double negative with the question text.

Poor Example	Better Example

*All of the following are correct actions for putting out a fire in a pan on the stove **EXCEPT**:*
   a. Do not move the pan.
   *b. Pour water into the pan.
   c. Slide a fitted lid onto the pan.
	*All of the following are correct actions for putting out a fire in a pan on the stove **EXCEPT**:*
	   a. Leave the pan where it is.
	   *b. Pour water into the pan.
	   c. Slide a fitted lid onto the pan.

2.2.4.3. Example 3: Matching

In matching questions, candidates must select more than one correct element or statement. These elements are numbered and each multiple-choice answer presents a set of numbers.

Poor Example

The candidate is directed to identify the correct answer or answers by selecting one of a set of numbers, each of which represent a combination of alternatives. In the example below, a candidate can identify combination "e.**"** as the correct response simply by knowing that element 4 is correct.

Which Elements belongs to a Truss Wing Structure?
> *1. Nose Rib*
> *2. N Girder*
> *3. Laminates*
> *4. Rear Spar*

The correct answer is:
> *a. 1 and 2*
> *b. 2 and 3*
> **c. 1 and 4*

Better Example

Which Elements belongs to a Truss Wing Structure?
> *1. Nose Rib*
> *2. N Girder*
> *3. Laminates*
> *4. Rear Spar*

The correct answer is:
> *a. 1 and 2*
> *b. 2 and 3*
> **c. 1 and 4*

2.2.4.4. Example 4: Each question assess a single written objective

Questions that are not written with a specific objective in mind often end up measuring lower-level objectives exclusively, or covering trivial material that is of little educational worth.

Often a situation is the foundation of the question. After reading the situation, the candidate should know exactly what the problem is and what he or she is expected to do to solve it. If the candidate has to infer what the problem is, the question will likely measure the candidate's ability to draw inferences from vague descriptions rather than his or her achievement of a module objective.

Objective: Applicant knows the chief difference between production of lift of helicopters and airplanes.

Poor Example	Better Example
Helicopters:	*In order to fly there is a difference in principle between helicopters and airplanes to produce lift. What is the correct answer?*
*a. Need a rotor.	
b. Need wings.	*a. Helicopters use a rotor system; airplanes use vertical jet propulsion.*
c. Need a long runway.	*b. Helicopters use a rotor system; airplanes use a vertical propeller system.*
	*c. Helicopters use a rotor system; airplanes use wings.

2.2.4.5. Examples 5: Direct Question

As illustrated in the following examples, the questions may consist of either a direct question or an incomplete sentence, whichever presents the problem more clearly and concisely.

In the vast majority of civilian airplanes in which seat does the pilot in command sit ?
   *a. Left-hand.
   b. Right-hand.
   c. Back seat.

the direct question should be separated clearly from the preliminary information by a following empty line. The direct question should begin in a new line and should – if possible – appear in a different colour.

Poor Example

For most FMS the Fuel prediction function, which computes the remaining fuel along the flight plan, takes into account the following situations:
   1- the additional drag resulting in a flight carried out with the landing gear extended.
   2- the current wind computed or the resulting ground speed.
   3- the additional drag resulting in a flight carried out with the flaps stuck, partly extended.
      What is the correct combination?

Better Example

For most FMS the Fuel prediction function, which computes the remaining fuel along the flight plan, takes into account the following situations:
   1- the additional drag resulting in a flight carried out with the landing gear extended.
   2- the current wind computed or the resulting ground speed.
   3- the additional drag resulting in a flight carried out with the flaps stuck, partly extended.

   What is the correct combination?

2.2.4.6. Example 6: Incomplete Sentence

The pilot in command sits in the vast majority of civilian airplanes in ?
      *a. the Left-hand seat.
      b. the Right-hand seat.
      c. the Back seat.

2.2.4.7. Example 7: Optimization of question text phrasing

Excess material in the question text that is not essential to answering the problem increases the reading burden and adds to candidates confusion over what he or she is being asked to do.

Poor Example

Suppose you are a mathematics professor who wants to determine whether or not your teaching of the unit on probability has had a significant effect on your candidates. You decide to analyze their scores from a test they took before the instruction and their scores from another exam taken after the instruction. Which of the following t-tests is appropriate to use in this situation?

> **a. Dependent samples. b. Independent samples.*
> *c. Heterogeneous samples.*

Better Example

When analyzing your candidates' pre-test and post-test scores to determine if your teaching has had a significant effect, an appropriate statistic to use is the t- test for:

> **a. Dependent samples. b. Independent samples.*
> *c. Heterogeneous samples.*

The question text of the poor example above is excessively long for the problem it is presenting. The question text of the better example has been reworded to exclude most of the irrelevant material, and is less than half as long.

2.2.4.8. Example 8: Optimization of answer text phrasing

Include as much of the question as possible in the question text, but do not include irrelevant material.

Rather than repeating redundant words or phrases in each of the alternatives, place such material in the question text to decrease the reading burden and more clearly define the problem in the question text.

Poor Example	Better Example
If the pressure of a certain amount of gas is held constant, what will happen if its volume is increased? *a. The temperature of the gas will decrease.* **b. The temperature of the gas will increase.* **c. The temperature of the gas will become zero.*	*If you increase the volume of a certain amount of gas while holding its pressure constant, its temperature will:* *a. Decrease.* **b. Increase.* *c. become zero.*

Notice how the underlined words are repeated in each of the alternatives in the poor example above. This problem is fixed in the better example, where the question text has been reworded to include the words common to all of the alternatives.

2.2.4.9. Example 9: Keep the answers mutually exclusive

Answers that overlap create undesirable situations. Some of the overlapping answers maybe easily identified as false answers. On the other hand, if the overlap includes the intended answer, there may be more than one answer that can be successfully defended as being the answer.

Poor Example	Better Example
If an 80 ohm coaxial cable is connected to an 80 ohm dipole aerial, resistance would be: *a. more than 60 ohm* *b. less than 160 ohm* *c. 40 ohm*	*If an 80 ohm coaxial cable is connected to an 80 ohm dipole aerial, resistance would be.* *a. 60 ohm* *b. 160 ohm* *c. 40 ohm*

In the poor example above, all the answers overlap. In the better example, the answers have been rewritten to be mutually exclusive.

2.2.4.10 Example 10: Keep the answers homogeneous in content

If the answers consist of a potpourri of statements related to the question text but unrelated to each other, the candidate's task becomes unnecessarily confusing. Answers that are parallel in content help the question present a clear-cut problem more capable of measuring the attainment of a specific objective.

Poor Example	Better Example
Boeing 747 is widely known as: **a. The airplane called "Jumbo-Jet".* *b. The airplane with a good reliability.* *c. Best-selling airlines airplane.* *d. Best-selling military airplane.*	*Boeing 747 is widely known as:* **a. "Jumbo-Jet".* *b. "Walrus-Jet".* *c. "Elephant-Jet".*

The poor example contains answers testing knowledge of maintenance aspects (reliability), market position (best selling) and nicknames. If the applicant misses the question, it does not tell the examiner in which of the three areas the candidate is weak. In the better example, all of the answers refer to nick names, so if the candidate misses the question, it tells the examiner that the candidate has a weakness in that area.

2.2.4.11 Example 11: Keep the grammar of each answer consistent with the question text.

Candidates often assume that inconsistent grammar is the sign of a false answer, and they are generally right.

Poor Example	Better Example
A word used to describe a noun is called an: **a. Adjective.* *b. Conjunction.* *c. Pronoun.*	*A word used to describe a noun is called:* **a. an adjective.* *b. a conjunction.* *c. a pronoun.*

2.2.4.12 Example 12: Keep the answers similar in length

An answer noticeably longer or shorter than the other is frequently assumed to be the answer, and not without good reason.

Poor Example	Better Example
If the static source of an altimeter becomes blocked during a descent the instrument will: **a. continue to display the reading at which the blockage occurred.* *b. gradually indicate zero.* *c. under-read.*	*If the static source of an altimeter becomes blocked during a descent the instrument will:* **a. continue to display the reading at which the blockage occurred.* *b. gradually indicate zero shortly after which the blockage occurred.* *c. under-read shortly after which the blockage occurred.*

Notice how the answer stands out in the poor example above. The false answers have been reworded in the better example to make the answer lengths more uniform.

2.2.4.13 Example 13: Avoid the use of specific determiners

When words such as *never*, *always*, and *only* are included in false answers in order to make them false, they serve as flags to the alert candidate.

Poor Example	Better Example
A lead-acid battery is considered to be fully charged *a. <u>always</u> when the SG reaches 1.180.* **b. <u>always</u> when cells begin to gas freely.* *c. when SG and voltage <u>never</u> remain constant.*	*A lead-acid battery is considered to be fully charged when the* *a. SG reaches 1.180.* **b. cells begin to gas freely.* *c. SG and voltage remain constant.*

In the poor example above, the underlined word in each of the false answers is a specific determiner. These words have been removed from the better example by rewording both the question text and the false answers.

2.2.5. General Checklist Multiple-choice

It is recommended to use a check-list when drafting a multiple-choice question. Example for Part 66:

CAAB Part-66	General Checklist Multiple-choice
Item	**Check**
Learning Objective(s)	☐ Identification of the assigned learning objective(s)
Relevance to Part-66 Appendix 1 syllabus:	☐ Consistency between proposed question and Part-66 module/subject ☐ Consistency between Module/Subject and Category ☐ Conformity with Appendix 1 examination level
Conformity with question standard	☐ Wording of the question in compliance with the setting up methodology ☐ Format of the question in compliance with the setting up methodology ☐ Abbreviations in compliance with the setting up methodology ☐ The use of unit in compliance with international and national rules and style conventions11

2.2.6. Wording Checklist Multiple-choice

CAAB	Wording Checklist Multiple-choice
Item	**Check**
Content	☐ Is the question really relevant? ☐ Is the knowledge level adequate? ☐ Is the content indisputable? ☐ Is the information sufficient? ☐ Is the wording clear and unequivocal? ☐ Are all abbreviations, technical terms and foreign words known by the target group?
Question	☐ Can one find the correct answer without reading the alternative answers? ☐ Are negations highlighted? ☐ Isn't the Question a catch question?
Answers	☐ Is the true answer clearly recognizable? ☐ Are the false answers plausible and justified? ☐ Are the choice answers homogeneous with regard to text length and grammar? ☐ Are double negations avoided? ☐ Are absolute statements avoided ("always", "all", never")? ☐ Are word repetitions avoided from the problem description?
If necessary Embedded diagrams	☐ are all graphics available in the correct version? ☐ are all graphics in readable conditions?
If necessary Annexes	☐ are all annexes available in the correct version? ☐ are all annexes in readable conditions?

3   Use of Diagrams

3.1.   General

Due to the technical content of all modules, the use of diagrams for examinations makes sense. For the evaluation of technical components next to a technical test procedure an optical testing is very important. In this respect the use of sketches, abstracts, engine element drawings, diagrams and photos as part of examination questions for certifying staff is an adequate mean of knowledge verification.

It is not always decisive if the exercise can <u>only</u> be solved by interpretation of the used graphic(s). In many cases diagrams are an indicator for achieving a higher clarity of a relevant problem.

3.2.   Diagram Types
In principle diagram types can be differentiated between:

- ☐   Black and white drawings.

- ☐   Black and white photos.

- ☐   Coloured drawings.

- ☐   Coloured photos.

3.3.   Set Up of diagrams
(a) Copying

(b) Own photos

(c) Self generation or edition of drawings, photos, etc.

☐   Standardization of graphic sizes

According to content and purpose of used graphics and images certain size ranges can be defined. When saving graphics defined size ranges shall be kept. The use of certain sizes should not cause blurring. The consideration of certain widths proved of value. The respective height depends on according content. If graphics are directly located on the exercise text they are called embedded graphics.

Following illustration shows different size ranges for embedded graphics.
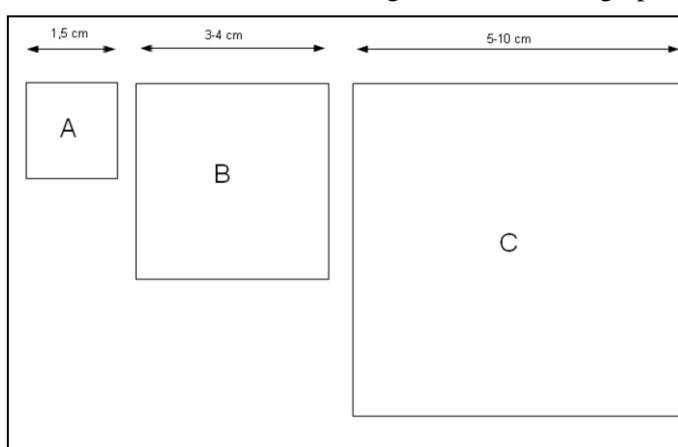
Bigger diagrams, f. e. phantom drawings, are saved as attachments (annex). Such diagrams are shown in a separate page at the end of *paper & pencil* examinations.

Only for examination purposes!
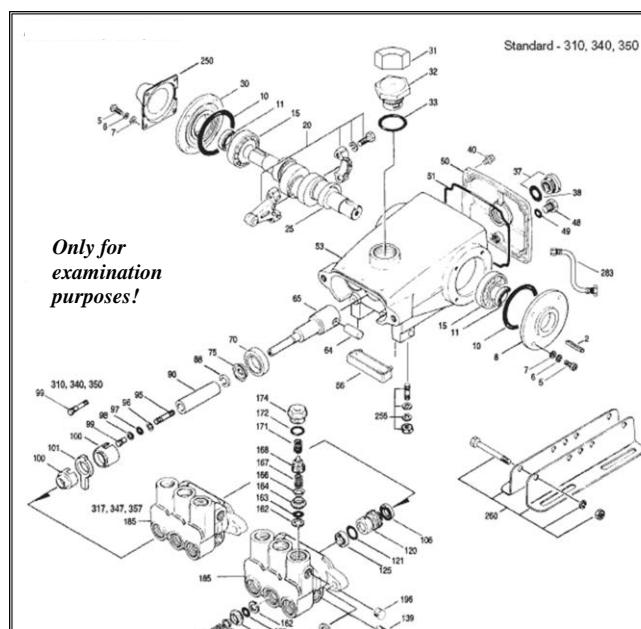
3.4. Check list "Using diagrams"

CAAB	Checklist Diagrams
☐	Copy right conditions?
☐	Does the graphic match the question?
☐	Are all relevant elements clearly identifiable?
☐	Sufficient labelling?
☐	Flawless quality of display?
☐	If a diagram is attached: does the question include an appropriate note?